Ad Hoc Committee on Amateur Radio Digital Communication
Redondo Beach, CA
August 30, 1987

MINUTES

1. In Attendance

Members

Paul L. Rinaldo, W4RI (Chairman)
Thomas W. Comstock, N5TC (Board Liaison)
Lyle Johnson, WA7GXD
Phil Karn, KA9Q
Wally Linstruth, WA6JPR
Doug Lockhart, VE7APU
Hank Magnuski, KA6M
Harold Price, NK6K

Representing MSC, VUAC and VRAC

Jay A. Holladay, W6EJJ (MSC) (afternoon only)
H. Paul Shuch, N6TX (Chairman, VUAC)
Karl Pagel, N6BVU (Chairman, VRAC) (afternoon only)

Observers

Bob Albrightson, N7AKR
Scott Avent, N6BGW
David A. Avery
Orv Beach, WB6WEV
Jon Bloom, KE3Z
Mike Brock, WB6HHV
Mike Chepponis, K3MC
Tom Clark, W3IWI
John Conner, WDØFHG
Tom Eagle, KØJPR
James T. Fortney, K6IYK
Andy Freeborn, NØCCZ
Bdale Garbee, W3EUA
Bob Gobrick, WA6ERB
Dennis Goodwin, KB7DZ
Eric Gustafson, N7CL
Skip Hansen, WB6YMH
Robert B. Hoffman, N3CVL
Stan Horzepa, WA1LOU
Brian Kantor, WB6CYT
Thomas Kieselbach, DL2MDE
Thomas King, KA6SOX
Brian Lloyd, WB6RQN
Hugo Lorente, LU4DXT
Bill Martin, WA6SBV
Isao Matsuo, JA1IJX
Bob McGwier, N4HY

Morning Session

2. 6th ARRL Computer Networking Conference

Mr. Price reported on the conference held the previous day. About 240 were in attendance. Mr. Price commented that the schedule of presentations filled the single day of the conference

and that, in future, it may be necessary to either select which papers would be presented or extend the conference to two days. Mr. Rinaldo remarked that Messrs Price and Linstruth, along with TRW ARC, had done an excellent job on organizing the conference. (Applause)

3. 7th Computer Networking Conference

The location for the next conference was discussed. Mr. Freeborn proposed the Denver area. Mr. Rinaldo relayed a message from Mr. Fox (who could not attend this meeting) that he thought it was time to have one in the Washington, DC area; Mr. Lloyd and Dr. Clark said that support would be provided. On the basis of the relative sizes of the local packet population and travel considerations, the committee VOTED in favor of Washington, DC, about the same time next year. Mr. Rinaldo noted that the Gaithersburg Hamfest (early September) would be a good co-attraction.

(On September 5, 1987, the ARRL Executive Committee approved holding of the 7th Amateur Radio Computer Networking Conference in the Greater Washington, DC area in August or September 1988.)

4. Emission Designators

Mr. Rinaldo opened a discussion of the proposed changes in the way amateur emissions are defined, and distributed copies of his proposal. He said that, while occupied bandwidth is important, it is also difficult to quantify without specifying both the -6 and -26 dB bandwidths. If that were done, many existing transmitters would fail the test, particularly those without steep roll-off characteristics. Further, in analyzing comments from amateurs relating to previous proposals on this subject, it has become apparent that amateurs wish to have emission types separated on the basis of information content (eg, voice, RTTY) rather than modulation system or bandwidth. Mr. Karn stated that bandwidth efficiency should be the primary concern. Mr. Rinaldo noted that a tradeoff exists between bandwidth and required S/N ratio. This tradeoff makes bandwidth efficiency a thorny requirement. Mr. Karn suggested that the need is for some incentive to use newer, more bandwidth-efficient, modulation systems. Mr. Price commented that the incentive is that such systems work better, and that the hobby nature of Amateur Radio means that not everyone needs to use state-of-the-art systems. Further, Mr. Price opposed legislating technology in the rules. Mr. Lockhart asked if such "gentlemen's agreements" as the separation between phone and RTTY should be legislated. Mr. Rinaldo stated that the majority of US amateurs commenting to the FCC have indicated that they prefer to have the FCC regulate this separation, at least in the HF bands. He said that his proposal would separate emissions by information type, but that some bandwidth restrictions would be retained to require good engineering practice.

5. New Packet Rules

Mr. Rinaldo noted that FCC Private Radio Bureau spokesmen have publicly asked for suggestions on rewriting portions of Part 97 dealing with packet radio. There was a general willingness for the committee to consider this subject at a subsequent meeting.

6. HF Autoforwarding STA Reporting

Mr. Rinaldo asked the committee to develop a list of reporting requirements for the conclusion of the HF autoforwarding STA. Those agreed at the meeting were:

- o any improper messages relayed and corrective action
- o any transmitter malfunction and corrective action
- o any interference complaints and corrective action
- o message statistics for a sample period (Thanksgiving week) addressed to SURVEY @ W3IWI (Tom subsequently confirmed that he has already set up a file called SURVEY.TXT to receive these stats.)

Afternoon Session

7. Frequency Recommendations for Packet Radio

First Vice President Holladay chaired the discussion of this item, representing the Membership Services Committee. Within the ARRL organization, this committee has overall responsibility for frequency recommendations. Also participating in the discussion were Karl Pagel, N6BVU, VRAC Chairman, and Paul Shuch, N6TX, VUAC Chairman. After a brief introduction, the discussion turned to the bands above 225 MHz. These bands were not included in the packet-radio frequency recommendations adopted (as interim guidance) by the ARRL Board of Directors at their July 1987 meeting. (See QST for September 1987, page 54, for a summary of the recommendations adopted at that meeting.)

a. Frequencies above 225 MHz

(1) General considerations

The following general considerations were noted regarding packet frequencies in the VHF/UHF region:

(a) There is a need for 100-kHz-wide channels in order to make use of the 56-kbit/s modems which have recently become available. This data rate is permitted only above 220.5 MHz.

(b) At the Computer Networking Conference several papers were presented which dealt with duplex vs simplex operation for packet radio. The conclusion is that in many situations, duplex operation is more efficient. For wideband systems, it is very difficult to build filters that provide adequate isolation for duplex operation in-band. Therefore, there is strong motivation toward crossband operation for the high-data-rate links. The favored approach is to pair frequencies for crossband links in the following manner: 220-420, 420-902, 902-1240, etc.

(2) 70 centimeters

(a) The 70-cm (420-450 MHz) band presents the most difficult situation of any band in trying to recommend frequencies for packet radio. Existing heavy usage of the band in almost all US metropolitan areas makes it impossible to recommend frequencies that would be applicable nationwide. After discussing the wide variations in packet frequencies in various parts of the country, the committee concluded that the 70-cm frequencies recommended in the committee's report were as good as any as a starting point. If they are available in a given area, they should be the first choice of the local frequency coordinator. If they are not available, then it is up to the local packet-radio operators to work out the best arrangement they can with the local coordinator. Digital operation will have to be fit in where it can, depending on the local situation. Since many of the links (especially the high-data-rate ones) will be point-to-point links, frequency-sharing arrangements should be possible by proper choice of antenna beamwidth, polarization and power levels.

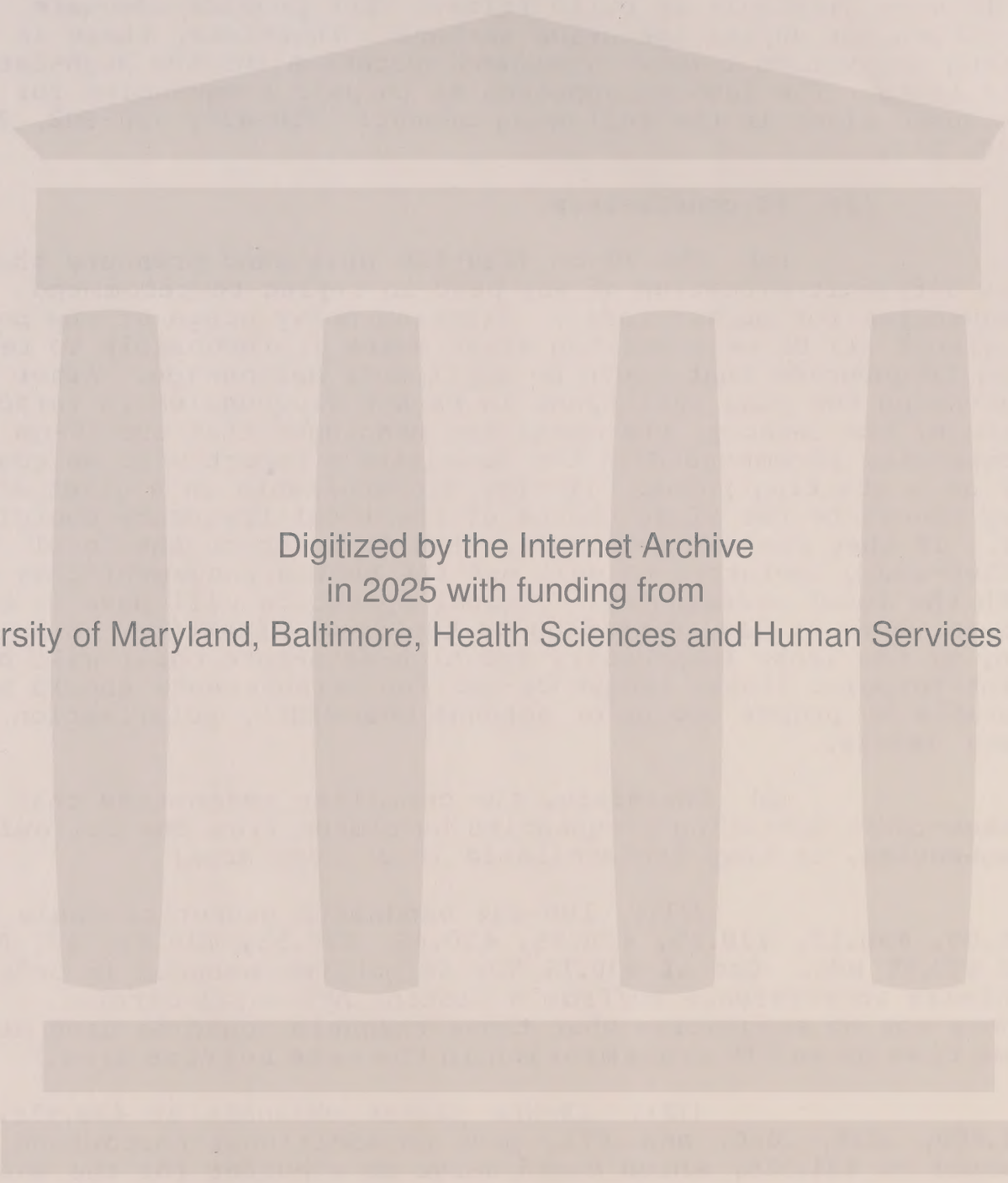
(b) Therefore, the committee recommends that packet-radio operating frequencies be chosen from the following frequencies, if they are available in a given area:

((1)) 100-kHz bandwidth packet channels at 430.05, 430.15, 430.25, 430.35, 430.45, 430.55, 430.65, 430.85, and 430.95 MHz. Use of 430.75 MHz is not recommended in order to minimize interference to/from a distant ATV aural carrier. (There was no suggestion that these channels could be used at the same time as an ATV transmission in the same service area.)

((2)) 25-kHz packet channels at 440.975, 441.000, .025, .050, and .075, plus an additional narrowband channel at 431.025, which could serve as a buffer for the wideband packet channels listed above.

(3) 33 centimeters

(a) There were some difficulties in the 33-cm (902-928 MHz) band created by Automatic Vehicle Monitoring (AVM) Systems and by industrial, scientific and medical (ISM) devices centered at 915 MHz. Nevertheless, there are a number of advan-



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tages associated with the band. Japanese Personal Radio Service equipment (available from Japan, but not yet imported into the United States in any significant quantity) is the only known source of transceivers, and they operate in the lower portion of the band. This band holds promise for ATV and for wideband data channels operated crossband with one at 70 or 23 cm. Relative to higher frequencies, it is easier to build and test equipment for this band because of the availablility of components and test equipment.

(b) Discussion of frequencies for digital communications on 33 cm began with the observation that the band plan published in the 1987 Repeater Directory is an interim one. The VRAC and VUAC are being requested to revisit this band plan in the light of a revised version recently adopted in Southern California. Among other things the Southern California plan reduces the weak-signal allocation to 902-903 MHz and moves most other allocations down 1 MHz. This results in the following differences in digital-mode allocations:

ARRL Interim	S California
904-906	903-905
916-918	915-917

(c) Digital Committee members recommended that two 3-MHz-wide channels be allocated (to accommodate 1.5 Mbit/s links) with 10.7-MHz spacing. This could be accomplished with channels at 903-906 and 914-917 MHz.

(4) 23 centimeters

(a) The committee found the band plan for 23 cm (1240-1300 MHz) the easiest on which to reach agreement. The committee reaffirmed the earlier recommendations of the Digital Committee, which are consistent with the 23-cm band plan adopted by the ARRL Board, as published in the 1987 Repeater Directory. The recommendations are also in accord with the VUAC recommendations that a packet allocation be adopted in a portion of 23 cm available to Novices.

(b) The specific 23-cm packet frequency recommendations are as follows:

((1)) 2-MHz wide channels at 1249.0, 1251.0 and 1298.0 MHz.

((2)) 100-kHz wide channels at 1299.05, 1299.15, 1299.25, 1299.35, 1299.45, 1299.55, 1299.65, 1299.75, 1299.85 and 1299.95 MHz.

((3)) 25-kHz wide channels at 1294.025, 1294.050, 1294.075, 1294.100, 1294.125, 1294.150 and 1294.175. 1294.100 is designated the National packet calling frequency. These frequencies are available to Novice operators.

b. Comments on previously adopted frequency recommendations

The packet-radio frequency recommendations (for frequencies below 225 MHz) adopted as interim guidance by the ARRL Board of Directors at Minute 56 of their July 1987 meeting were reviewed briefly. The following comments were noted:

(1) These frequency recommendations were not reviewed by the VRAC prior to their adoption by the Board. The VRAC chairman pointed out that some of the 220-MHz frequencies recommended (below 225 MHz) are used in various parts of the country for control links. Therefore, whenever this band plan is published, it should clearly state that use of the recommended channels must be coordinated through the local frequency coordinator.

(2) With regard to the 20-meter frequencies, Thomas Kieselbach, DL2MDE, recommended that 14097.3 be designated for message forwarding in Region 1, in view of the Region 1 band plan and heavy SSB activity above 14100 MHz.

(3) A note should be added to the HF packet recommendations to the effect that the FCC has not yet authorized 1200-baud operation below 28 MHz.

c. Future action

After review by the VRAC and VUAC, the final recommendations will be submitted to the ARRL Board of Directors via the Membership Services Committee. An attempt will be made to expedite review of the 33-cm band plan.

Respectfully submitted,

Paul L. Rinaldo, W4RI
Chairman

No. 87-10
Copies sent to all
Digital Committee members
Date: JUL 11, 87

ARRL BULLETIN 59 FROM ARRL HEADQUARTERS
NEWINGTON CT JULY 11, 1987
TO ALL RADIO AMATEURS

THE ARRL BOARD OF DIRECTORS HELD ITS SECOND 1987 MEETING IN ATLANTA, GEORGIA ON JULY 9 AND 10. IN CONSIDERING THE FCC PROPOSAL FOR PRIVATIZATION OF THE SPECIAL CALL SIGN SYSTEM, THE ARRL BOARD FIRST STRONGLY SUPPORTED THE CONCEPT THAT THE ASSIGNMENT AND ISSUANCE OF CALL SIGNS IS A GOVERNMENTAL FUNCTION WHICH SHOULD BE CARRIED OUT BY THE FCC. IF THE FCC NEVERTHELESS DECIDES TO DELEGATE A PART OF THE FUNCTION, THE ARRL WOULD SEEK TO UNDERTAKE IT, SUBJECT TO CERTAIN CONDITIONS. AMONG THESE ARE THERE BEING ONLY ONE ENTITY, THE FCC CONTINUING TO ISSUE LICENSES AND INITIAL CALL SIGNS, FCC CONTINUING TO MAINTAIN ITS OWN DATABASE, AND THE PROGRAM BEING SELF SUPPORTING UNDER A REASONABLE FEE SYSTEM. THE LEAGUE WILL PETITION THE FCC TO REQUIRE EXPRESS FCC APPROVAL FOR REACCREDITATION OF ANY PROSPECTIVE VOLUNTEER EXAMINER WHOSE PREVIOUS EXAMINER STATUS HAS BEEN SUSPENDED OR REVOKED BY ANY VEC.

THE ARRL HUMANITARIAN AWARD WAS CONFERRED ON FATHER MORAN, 9N1MM. SCOTT L. YOUNG, N9FZS, WAS SELECTED TO RECEIVE THE 1986 HIRAM PERCY MAXIM AWARD. THE 1986 TECHNICAL EXCELLENCE PEWTER CUP GOES TO RICH ARNDT WB4TLM AND JOE FIKES KB4KVE FOR THEIR APRIL 1986 QST ARTICLE ON CAPACITIVE FILTERS.

LOOKING AHEAD TO THE POSSIBILITY OF A FUTURE INTERNATIONAL CONFERENCE THAT MIGHT AFFECT AMATEUR RADIO FREQUENCY ALLOCATIONS, THE BOARD INSTRUCTED ITS OFFICERS TO BEGIN DEVELOPING A LONG RANGE PLAN FOR THE LEAGUE. AN HISTORIC AMENDMENT OF THE ARRL ARTICLES OF ASSOCIATION WAS ADOPTED EFFECTIVE JANUARY 1, 1988. IT COMPLETES ACTION ESTABLISHING AUTONOMY FOR THE CANADIAN RADIO RELAY LEAGUE, THE CANADIAN DIVISION OF THE ARRL SINCE 1920. THE BOARD AUTHORIZED THE REFURBISHING OF THE MAXIM MEMORIAL STATION W1AW AND RAISING OF FUNDS THEREFORE, BUT PLACED THE BUILDING OF A VISITORS CENTER AT HQ IN ABEYANCE UNTIL A MORE FORTUITOUS TIME. FUNDS WILL ALSO BE SOUGHT FOR A POSSIBLE NEW ARRL STATION TO SERVE THE WEST COAST ALASKA HAWAII AND THE PACIFIC. THE BOARD SELECTED DALLAS, TEXAS AS THE SITE OF THE DIAMOND JUBILEE NATIONAL CONVENTION JUNE 2 THROUGH 4, 1989. THE ARRL VOLUNTEER EXAMINER COORDINATOR PROGRAM WILL BE STUDIED BY THE VOLUNTEER RESOURCES COMMITTEE, WITH AN EYE TO STREAMLINING IT. STANDARD OPERATING PROCEDURES AND RULES FOR ADVISORY COMMITTEES HAVE BEEN REVISED.

THE BOARD ESTABLISHED THE ARRL NATIONAL EMERGENCY RESPONSE COMMITTEE, ANERCOM, TO PLAN AND MANAGE AMATEUR RADIO RESPONSE TO DISASTERS. A MEMO OF UNDERSTANDING WITH THE WEATHER SERVICE WAS AUTHORIZED.

NOVICE ELIGIBILITY FOR ARRL LEADERSHIP AND STATION APPOINTMENTS HAS BEEN EXTENDED. A DIAMOND JUBILEE WORKED ALL STATES AWARD FEATURING THE 12 METER BAND WAS AUTHORIZED. PLAQUES WILL BE PROVIDED TO THE FIRST 10 AMATEURS TO MAKE DXCC ON 6 METERS AND THE FIRST 10 ON 2 METERS.
THE LEGAL STRATEGY COMMITTEE WILL DEVELOP GUIDELINES FOR ARBITRATION AND MEDIATION OF DISPUTES BETWEEN REPEATER COUNSELS. AN INTERIM BAND PLAN FOR PACKET RADIO ON FREQUENCIES UP TO 225 MHZ WAS ADOPTED. ADVISORY COMMITTEES WERE ASKED TO STUDY PACKET PLANNING FOR HIGHER BANDS. OTHER STUDIES INCLUDE WAYS TO REACH STATE AND LOCAL PLANNING AND LANDUSE BODIES WITH INFORMATION ON ANTENNA RULES, FEASIBILITY OF A POLITICAL ACTION COMMITTEE FOR AMATEUR RADIO, AND RELOCATED BEACON FREQUENCIES.

MINUTES OF THE MEETING WILL BE IN THE SEPTEMBER ISSUE OF QST. THE NEXT MEETING OF THE BOARD WILL BE IN HARTFORD, CONNECTICUT ON JANUARY 22 AND 23, 1987.

RECEIVED
87 JUL 10 AM 11:13

FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

JUL 7 1987

IN REPLY REFER TO:
7230-J

No. 87-11
Copies sent to all
Digital Committee members
Date: 7-7-87

Mr. David Sumner
Executive Vice President
The American Radio Relay League
Newington, Connecticut 06111

Dear Mr. Sumner:

This is in response to your request for special temporary authority (STA) and waiver of certain FCC rules in order to permit certain automatically controlled amateur stations to conduct experiments involving packet switched transfer of messages while transmitting on HF amateur service bands. Attached to your request are individual requests from the participating station licensees.

On October 6, 1986, the FCC adopted a Memorandum Opinion and Order in PR Docket No. 85-105 which deferred consideration of the matter of automatic control of amateur stations transmitting digital communications on amateur service frequencies below VHF. The FCC did not authorize such action because of the greater possibility of congestion than on VHF and above. The American Radio Relay League (ARRL) stated in that proceeding that such an authorization would be premature while operating standards are still evolving. ARRL said that it planned to coordinate a small group of packet radio enthusiasts, not limited to ARRL members, to request special temporary authorization to determine the feasibility of such operation. The FCC stated that organized feasibility projects conducted by a manageable group of amateur stations such as that planned by the ARRL will be helpful in determining any rules necessary to prevent interference to and from other amateur operations.

Your request is consistent with the FCC's decision. Accordingly, an STA is granted for a period of 180 days commencing with the date of this authorization for the amateur stations listed on the enclosure. During this time, Section 97.69(d) is waived to the

extent that these particular amateur stations may be under automatic control when transmitting digital communications below 29.7 MHz, and Section 97.80(b) is waived to the extent that these stations may be operated under automatic control while retransmitting third-party traffic under the same conditions as permitted stations retransmitting digital packet communications on frequencies above 50 MHz.

The above authorization will also apply to any additional amateur stations joining the project during the period of the STA, provided the ARRL submits an amended list and individual requests.

I wish you and the participants every success with the project.

Sincerely,

Michael T. N. Fitch
Chief, Private Radio Bureau

Enclosure

cc with enclosure:
Licensees listed on enclosure

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ARRL COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

Torrance, CA
August 30, 1987

PACKET RADIO FREQUENCY RECOMMENDATIONS

Agenda

1) Introduction, Background

2) 70-cm and Above
   - Current Status
   - Issues
   - Tentative Recommendations

3) Interim Bandplan adopted at Minute 56
   - New Considerations
   - Issues

4) Future Action
   - Recommendations for Jan. 1988 Board Meeting

From Minutes of July 1987 Board Meeting:

56) .....The Packet Radio frequency recommendations of the Ad Hoc Committee on Amateur Radio Digital Communications for frequencies below 225 MHz are adopted as interim guidance, and, in recognition of regional differences and the rapid expansion of this mode, the Ad Hoc Committee is requested to continue development of frequencies for consideration by the Board through the Membership Services Committee....

92) .....it was VOTED that the information contained in the Interim Band Plan for Packet Radio adopted by the Board, along with the frequencies in the 70-cm band and above contained in the Report of the Committee on Amateur Radio Digital Communications be referred to the VRAC and VUAC for their study and recommendations. A joint report shall be presented to the Board at the 1988 Annual meeting.

Packet Radio Frequency Recommendations of the Ad Hoc Committee on Amateur Radio Digital Communication

These recommendations are in response to Board Minutes 45(a) (study designation of packet-radio traffic channels) and 45(h) (study recommended operating frequencies for VHF packet and HF packet radio) of the 1986 Annual Meeting and Minute 80 of the 1987 Annual Meeting.

1. General

According to Part 97 of the FCC rules, packet radio may be operated on any frequency where digital communications is permitted.

2. Frequency References

A. The primary references to packet-radio frequencies should be by center frequencies.

B. Display frequencies (what appears on the transceiver frequency readout) are not uniform and should be used only for secondary reference when transceiver settings and modem center frequencies are known. Mark and space frequencies vary according to the modem in use.

3. 80-20 Meter Bands

A. General:

(1) The packet-frequency selection objective is to minimize impact on existing operations, recognizing that the spectrum in these HF bands is a limited resource.

(2) Using the spectrally conservative mode of minimum-shift keying (MSK), 1200-baud operation should be possible within a 2-kHz bandwidth. Thus, a 2-kHz raster is recommended for packet frequencies in these bands.

B. The use of the RTTY subbands is encouraged for packet operations in these bands. The frequencies listed below are exceptions to this general rule to provide usable channels for automatic message forwarding:

(1) 80 Meters (kHz)
3594.3 Intercontinental message forwarding
3607.3 North American message forwarding

(2) 40 Meters (kHz)
7038.3 Intercontinental message forwarding
7091.3 North American message forwarding

(3) 30 Meters (kHz)
10145.3 Intercontinental message forwarding
10147.3 North American message forwarding

Note: These frequencies are subject to noninterference with fixed stations outside the United States.

(4) 20 Meters (kHz) (Experimental)
14102.3 Intercontinental message forwarding
14108.3 Intracontinental message forwarding

Note: The lowest frequency provides sufficient protection to receivers using CW bandwidths to receive 14100-kHz beacons.

4. 160 and 17-10 Meters

The frequencies listed below conform to the RTTY subbands and are suggested for automatic message forwarding when propagation is favorable.

A. 160 Meters (kHz)
1802.3

B. 17 Meters Pending FCC Allocation (kHz)
18106.3
18108.3

C. 15 Meters (kHz)
21096.3
21098.3

D. 12 Meters (kHz)
24926.3
24928.3

E. 10 Meters (kHz)
28102.3
28104.3

Note: These 28-MHz frequencies may be considered for both automatic message forwarding and network entry points for Novices and Technicians.

5. VHF/UHF Frequencies (MHz)

A. Specific VHF/UHF channels recommended below may not be available in all areas of the US.

(1) Prior to regular packet-radio use of any VHF/UHF, it is advisable to check with the local frequency coordinator.

(2) The decision as to how the available channels are to be used should be based on coordination between local packet-radio users.

B. 6 Meters

(1) National packet simplex frequency: 51.70

(2) Duplex pairs to consider for local coordination for uses such as repeaters and meteor scatter:

50.62/51.62	50.72/51.72
50.64/51.64	50.74/51.74
50.66/51.66	50.76/51.76
50.68/51.68	50.78/51.78

Note: Where duplex packet-radio stations are to be co-sited with voice repeaters, use high-in, low-out to provide maximum frequency separation from low-in, high-out voice repeaters.

C. 2 Meters

(1) Automatic/unattended operations should be conducted on 145.01, 145.03, 145.05, 145.07 and 145.09 MHz.

(a) 145.01 should be reserved for inter-LAN use.

(b) Use of the remaining frequencies (above) should be determined by local user groups.

(2) Additional frequencies within the 2-meter band may be designated for packet-radio use by local coordinators.

D. 1.25 Meters

(1) 100-kHz-bandwidth channels:

220.55	220.75	220.95
220.65	220.85	

(2) 20-kHz-bandwidth channels:

221.01	
221.03	
221.05	
221.07	
221.09	
223.40	National packet simplex
223.42	Candidate packet simplex channels shared with FM voice simplex. Check with your local frequency coordinator prior to use.
223.44	
223.46	
223.48	

(2) 20-kHz-bandwidth channels:

221.01
221.03
221.05
221.07
221.09

223.40 National packet simplex calling

223.42 Candidate packet simplex channels
223.44 shared with FM voice simplex. Check
223.46 with your local frequency coordinator
223.48 prior to use.

E. 70 Centimeters

(1) The 70-cm band plan needs to be revamped because of the reallocation of the 420-430 MHz band above Line A and having to take a secondary status to land mobile usage in Buffalo, Detroit and Cleveland. Furthermore, it has no place for data communications without some contention with other modes.

(2) 100-kHz-bandwidth channels:

430.55
430.65
430.85
430.95

(3) 25-kHz-bandwidth channels:

440.975
441.000 Message forwarding
441.025
441.050
441.075

(4) Cross-border packet with Canada should be conducted within the 433-434 MHz band as the DOC has allocated this band for packet transmissions not exceeding 100 kHz in bandwidth.

F. 33 Centimeters

Requires further study before nominating specific packet frequencies. The interim band plan adopted at the October 1984 Board Meeting should be reviewed in light of importation of Japanese Personal Radio Service equipment. The PRS transceivers are about all there is likely to be for some time, except for transverters. Use of the PRS radio equipment would help populate the band. The study question is: If it is desirable to encourage importation of PRS radios, does this signal a need to reconsider the band plan?

G. 23 Centimeters

(1) 2-MHz channels:

1249, 1251, 1298 MHz

(2) 100-kHz channels:

1299.05
1299.15
1299.25
1299.35
1299.45
1299.55
1299.65
1299.75
1299.85
1299.95

(3) 25-kHz channels:

1294.025
1294.050
1294.075
1294.100 National packet calling
1294.125
1294.150
1294.175

6. Higher Bands

Requires further study.

Respectfully submitted,

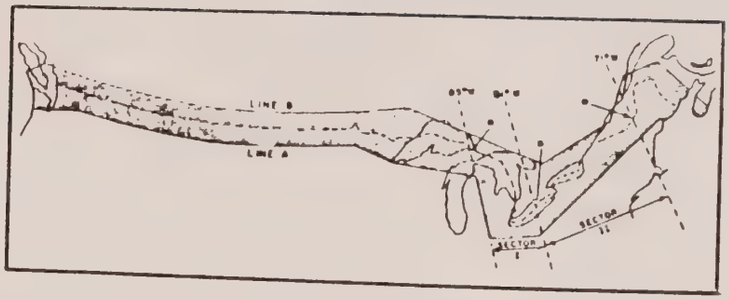
Paul L. Rinaldo, W4RI
Chairman

420-450 MHz

The following band plan is currently under review by the ARRL VHF-UHF Advisory Committee.

420.00-426.00	ATV repeater or simplex with 421.25 MHz video carrier, control links and experimental
426.00-432.00	ATV simplex with 427.250 MHz video carrier frequency
432.00-432.070	EME (Earth-Moon-Earth)
432.07-432.08	Propagation beacons
432.08-432.10	Weak signal CW
432.100	70-cm calling frequency
432.10-432.125	Mixed mode and weak signal work
432.125-432.175	OSCAR inputs
432.175-433.00	Mixed mode and weak signals
433.00-435.00	Auxiliary/repeater links
435.00-438.00	Satellite only (Internationally)
438.00-444.00	ATV repeater input with 439.250 MHz video carrier frequency and repeater links
442.00-445.00	Repeater inputs and outputs (local option)
445.00-447.00	Shared by auxiliary and control links, repeaters and simplex (local option)
446.0	National Simplex Frequency
447.00-450.00	Repeater inputs and outputs (local option)

Comments concerning packet-radio frequencies in this band may be sent to the VUAC and VRAC member in your Division.



The band is shared by amateurs with Government Radio location services (RADAR); amateurs must not interfere with these priority Government stations. As part of WARC-79 proceedings, the 420-430 MHz portion of the band was removed from the Amateur Radio Service north of Line A (see figure).

In a later action, FCC allocated portions of the band 421-430 MHz to the Land Mobile Service within 50-mile radii centered on Buffalo, Detroit and Cleveland. Amateur stations south of Line A in the vicinities of these cities may continue to operate in the 421-430 MHz spectrum as long as they do not cause interference to land mobile or government radiolocation users. Additionally, 50-watt PEP output power limitations apply to certain amateurs operating within circles of designated military installations in the US. [See §97.3(i) and §97.7(g)(6)]

902-928 MHz(1)

The following interim bandplan was adopted at the ARRL Board of Directors meeting in October 1984.

Segment	*Use*	*Footnotes*
902-904 MHz	Narrow bandwidth, weak signal communications	
902.0-902.8	SSTV, Fax, ACSSB, experimental	
902.8-903.0	Reserved for EME, CW expansion	
903.0-903.05	EME exclusive	
903.07-903.08	CW beacons	
903.1	CW, SSB calling frequency	
903.4-903.6	Crossband Linear Translator inputs	
903.6-903.8	Crossband Linear Translator outputs	
903.8-904.0	Experimental beacons exclusive	
904-906	Digital Communications	(2,8)
906-907	Narrow bandwidth FM simplex services, 25 kHz channels	(6)
906.50	National simplex frequency	
907-910	FM repeater inputs, paired with 919-922 MHz;119 pairs every 25 kHz, e.g. 907.025, 050, 075, etc. 908-920 MHz uncoordinated pair.	(2,4)
910-916	ATV	(2,3)
916-918	Digital Communications	(2,8)
918-919	Narrow bandwidth, FM control links and remote bases	
919-922	FM repeater outputs, paired with 907-910 MHz	(2,4)
922-928	Wide bandwidth experimental, simplex ATV, Spread Spectrum	(5,7)

Footnotes

1) Extracts of FCC Rules & Regulations, paragraph 2.106 "Table of Frequency Allocations" modified by General Docket 80-739, 8 Dec. 1983: Footnote US-267: "In the band 902-928 MHz, Amateur Radio stations shall not operate within the states of Colorado and Wyoming, bounded by the area of: latitude 39°N-42°N and longitude 103°W-108°W." Footnote US-275: "The band 902-928 MHz is allocated on a secondary basis to the amateur service subject to not causing harmful interference to the operations of Government stations authorized in this band or to Automatic Vehicle Monitoring (AVM) systems. Stations in the amateur service must tolerate any interference from the operations of industrial, scientific and medical (ISM) devices, AVM systems and the operations of Government stations authorized in this band."
2) Coordinated frequency assignments required.
3) ATV assignments should be made according to modulation type, e.g. VSB-ATV, SSB-ATV or combinations. Coordination of multiple uses of a single channel in a local area can be achieved through isolation by means of cross-polarization and directional antennas.
4) Coordinated assignments at 100 kHz until allocations are filled, then assign 50 kHz until allocations are filled, before assigning 25-kHz channels.
5) Simplex services only, permanent users shall not be coordinated in this segment. High altitude repeaters for other unattended fixed operations are not permitted.
6) Voice and non-voice operation.
7) Spread-spectrum requires FCC authorization.
8) Consult FCC R&R 97.69 for allowable data rates and bandwidths.

1240-1300 MHz

The following band plan was adopted by the ARRL Board of Directors meeting in January 1985.

Segment	*Use*	*Footnotes*
1240-1246	ATV #1	(2,3)
1246-1248	Narrow-bandwidth FM point-to-point links and digital, duplex with 1258-1260	(2)
1248-1252	Digital Communications	(2,8,9)
1252-1258	ATV #2	(2,3)
1258-1260	Narrow-bandwidth FM point-to-point links and digital, duplexed with 1246-1252	(2)
1260-1270	Satellite uplinks, reference WARC 1979	
1260-1270	Wide-bandwidth experimental, simplex ATV	(5,6)
1270-1276	Repeater inputs, FM and linear, paired with 1282-1288, 239 pairs every 25 kHz, e.g. 1270.025, .050, .075, etc. 1271.0-1283.0 uncoordinated test pair	(2,4,9,10)
1276-1282	ATV #3	(2,3)
1282-1288	Repeater outputs, paired with 1270-1276	(2,4,9,10)
1288-1294	Wide-bandwidth experimental, simplex ATV	(6)
1294-1295	Narrow-bandwidth FM simplex services, 25-kHz channels	(7)
1294.5	National FM simplex calling frequency	
1295-1297	Narrow bandwidth weak-signal communications (no FM)	
1295.0-1295.8	SSTV, FAX, ACSB, experimental	
1295.8-1296.0	Reserved for EME, CW expansion	
1296.0-1296.05	EME-exclusive	
1296.07-1296.08	CW beacons	
1296.1	CW, SSB calling frequency	
1296.4-1296.6	Crossband linear translator input	
1296.6-1296.8	Crossband linear translator output	
1296.8-1297.0	Experimental beacons (exclusive)	
1297-1300	Digital Communications	

Footnotes

1) Deleted
2) Coordinated assignments required.
3) ATV assignments should be made according to modulation type (for example), VSB-ATV, SSB-ATV, or combinations). Coordination of multiple users of a single channel in a local area can be achieved through isolation by means of cross polarization and directional antennas. DSB ATV may be used, but only when local and regional activity levels permit. The excess bandwidths from such users are secondary to the assigned services.
4) Coordinate assignments with 100-kHz channels, beginning at the lower end of the segment until allocations are filled, then assign 50-kHz channels until allocations are filled before assigning 25-kHz channels.
5) Wide bandwidth experimental users are secondary to the satellite service and may be displaced upon the installation of any new satellites. Users are EIRP-limited to the noise floor of the satellites in service and may suffer interference from satellite uplinks.
6) Simplex services only; permanent users shall not be coordinated in this segment. High-altitude repeaters or other unattended fixed operations are not permitted.
7) Voice and non-voice operations.
8) Consult 47 C.F.R. 97.69 (FCC regulations) for allowable data rates and bandwidths.
9) Provide guard bands at the higher frequency end of segments, as required, to avoid interference to ATV.
10) 1274.0-1274.2 and 1286.0-1286.2 MHz are optionally reserved for contiguous Linear Translators supporting multiple narrow bandwidth users. These may also be duplexed with other non-coordinated band segments.

Annex A. to Doc. #

PACKET RADIO FREQUENCY RECOMMENDATIONS OF THE AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

These recommendations are in response to Board Minutes 45(a) (study designation of packet-radio traffic channels) and 45(h) (study recommended operating frequencies for VHF packet and HF packet radio) of the 1986 Annual Meeting and Minute 80 of the 1987 Annual Meeting.

1. General

According to Part 97 of the FCC rules, packet radio may be operated on any frequency where digital communications is permitted.

2. Frequency References

A. The primary references to packet-radio frequencies should be by center frequencies.

B. Display frequencies (what appears on the transceiver frequency readout) are not uniform and should be used only for secondary reference when transceiver settings and modem center frequencies are known. Mark and space frequencies vary according to the modem in use.

3. 80-20 Meter Bands

A. General:

(1) The packet-frequency selection objective is to minimize impact on existing operations, recognizing that the spectrum in these HF bands is a limited resource.

(2) Using the spectrally conservative mode of minimum-shift keying (MSK), 1200-baud operation should be possible within a 2-kHz bandwidth. Thus, a 2-kHz raster is recommended for packet frequencies in these bands.

B. The use of the RTTY subbands is encouraged for packet operations in these bands. The frequencies listed below are exceptions to this general rule to provide usable channels for automatic message forwarding:

(1) 80 Meters (kHz)

3594.3	Intercontinental message forwarding
3607.3	North American message forwarding

(2) 40 Meters (kHz)

7038.3 Intercontinental message forwarding
7091.3 North American message forwarding

(3) 30 Meters (kHz)

10145.3 Intercontinental message forwarding
10147.3 North American message forwarding

Note: These frequencies are subject to noninterference with fixed stations outside the United States.

(4) 20 Meters (kHz)

14102.3 Intercontinental message forwarding
14108.3 Intracontinental message forwarding

Note: The lowest frequency provides sufficient protection to receivers using CW bandwidths to receive 14100-kHz beacons.

4. 160- and 17-10 Meters

The frequencies listed below conform to the RTTY subbands and are suggested for automatic message forwarding when propagation is favorable.

A. 160 Meters (kHz)

1802.3

B. 17 Meters Pending FCC Allocation (kHz)

18106.3
18108.3

C. 15 Meters (kHz)

21096.3
21098.3

D. 12 Meters (kHz)

24926.3
24928.3

E. 10 Meters (kHz)

28102.3
28104.3

Note: These 28-MHz frequencies may be considered for both automatic message forwarding and network entry points for Novices and Technicians.

5. VHF/UHF Frequencies (MHz)

A. Specific VHF/UHF channels recommended below may not be available in all areas of the US.

(1) Prior to regular packet-radio use of any VHF/UHF, it is advisable to check with the local frequency coordinator.

(2) The decision as to how the available channels are to be used should be based on coordination between local packet-radio users.

B. 6 Meters

(1) National packet simplex frequency: 51.70

(2) Duplex pairs to consider for local coordination for uses such as repeaters and meteor scatter:

50.62 - 51.62
50.64 - 51.64
50.66 - 51.66
50.68 - 51.68
50.72 - 51.72
50.74 - 51.74
50.76 - 51.76
50.78 - 51.78

Note: Where duplex packet-radio stations are to be co-sited with voice repeaters, use high-in, low-out to provide maximum frequency separation from low-in, high-out voice repeaters.

C. 2 Meters

(1) Automatic/unattended operations should be conducted on 145.01, 145.03, 145.05, 145.07 and 145.09 MHz.

(a) 145.01 should be reserved for inter-LAN use.

(b) Use of the remaining frequencies (above) should be determined by local user groups.

(2) Additional frequencies within the 2-meter band may be designated for packet-radio use by local coordinators.

D. 1.25 Meters

(1) 100-kHz-bandwidth channels:

220.55
220.65
220.75
220.85
220.95

(2) 20-kHz-bandwidth channels:

221.01
221.03
221.05
221.07
221.09

223.40 National packet simplex calling

223.42 Candidate packet simplex channels
223.44 shared with FM voice simplex. Check
223.46 with your local frequency coordinator
223.48 prior to use.

E. 70 Centimeters

(1) The 70-cm band plan needs to be revamped because of the reallocation of the 420-430 MHz band above Line A and having to take a secondary status to land mobile usage in Buffalo, Detroit and Cleveland. Furthermore, it has no place for data communications without some contention with other modes.

(2) 100-kHz-bandwidth channels:

430.55
430.65
430.85
430.95

(3) 25-kHz-bandwidth channels:

440.975
441.000 Message forwarding
441.025
441.050
441.075

(4) Cross-border packet with Canada should be conducted within the 433-434 MHz band as the DOC has allocated this band for packet transmissions not exceeding 100 kHz in bandwidth.

F. 33 Centimeters

Requires further study before nominating specific packet frequencies. The interim band plan adopted at the October 1984 Board Meeting should be reviewed in light of importation of Japanese Personal Radio Service equipment. The PRS transceivers are about all there is likely to be for some time, except for transverters. Use of the PRS radio equipment would help populate the band. The study question is: If it is desirable to encourage importation of PRS radios, does this signal a need to reconsider the band plan?

G. 23 Centimeters

(1) 2-MHz channels:

1249, 1251, 1298 MHz

(2) 100-kHz channels:

1299.05
1299.15
1299.25
1299.35
1299.45
1299.55
1299.65
1299.75
1299.85
1299.95

(3) 25-kHz channels:

1294.025
1294.050
1294.075
1294.100 National packet calling
1294.125
1294.150
1294.175

6. Higher Bands

Requires further study.

Respectfully submitted,

Paul L. Rinaldo, W4RI
Chairman

THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

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INTERNATIONAL AFFAIRS
JAMES E. McCOBB
K1LLU, TREASURER
QST
OFFICIAL JOURNAL

No. 87-12
Copies sent also all
Digital Committee members
Date: August 17, 1987

August 17, 1987

ARRL AD HOC COMMITTEE ON AMATEUR RADIO DIGITAL COMMUNICATION

Gentlemen:

MEETING NOTICE

As previously announced, there will be a meeting of the Digital Committee from 8 AM to 3 PM on August 30, 1987, at the Torrance Marriott Hotel, 3635 Fashion Way, Torrance, CA. This follows the Sixth ARRL Amateur Radio Computer Networking Conference to be held the previous day at the TRW cafeteria facility, Redondo Beach.

Although the agenda is still liquid, the following topics will be discussed:

Packet Frequencies

At the July ARRL Board Meeting, the Board accepted the Digital Committee's packet-frequency recommendations below 225 MHz. You will see them published as a sidebar in "Moved and Seconded" in September QST with only one minor modification -- the qualification "Experimental" with our 20-meter recommendations for international reasons. In the presentations to the Board made by the Digital Committee and Membership Services Committee chairmen, it became apparent that the coordination with the VHF/UHF Advisory Committee (VUAC) was incomplete and that the VHF Repeater Advisory Committee (VRAC) had not been involved in the process. Recognizing that the Digital Committee's recommendations for frequencies below 225 MHz were based largely on current practice on those bands, the Board decided to accept them so that the League could publish band-plan guidance on the most active packet bands. However, the Board decided that packet frequencies above 225 MHz did not have the same urgency and could wait until the January 1988 Board Meeting to allow the committees to complete the necessary coordination.

Please understand that the Board had no quarrel with any specific frequency recommendation above 225 MHz. It simply wants the process to ensure that it gets a single recommendation that reconciles the various constituent interests.

In the Board's wiring diagram, the Membership Services Committee (MSC) is the one charged with band planning. Thus, the Digital Committee, the VUAC and VRAC represent the different constituencies (e.g., digital, weak-signal and repeater) in the VHF/UHF bands and should work through the MSC (representing the overall interests of Amateur Radio) to get a coordinated recommendation to the Board. Since the Digital Committee is meeting in the LA area and as the chairmen of the VUAC and VRAC are California residents, it made sense to invite VUAC and VRAC representatives to the Digital Committee meeting. (Pardon my feeblish humor, but you could call this our Harmonic Convergence.) It appeared that MSC chairman Marshall Quiat might come to LA, but personal reasons obviated that. Fortunately, First Vice President Jay Holladay just happens to be a member of the MSC and a LA area resident, so he was asked to represent MSC.

After that long-winded intro, I have agreed to devote part of the Digital Committee meeting to coordination of packet band planning above 225 MHz. Jay Holladay will chair this part of the meeting to effect the necessary intercommittee coordination so that MSC can recommend a packet band plan for frequencies above 225 MHz to the Board next January. I am awaiting word via MCI from Jay as to whether he wants to have this session in the morning or the afternoon, so setting a specific agenda for the overall meeting will have to wait for that. The timing may depend on the availability of VUAC and VRAC reps, as well as that of Director Fried Heyn who is interested in helping.

If the above takes most of our meeting time, that's fine with me. We need to get these UHF/microwave packet frequencies nailed down in order to provide for orderly expansion into the higher bands.

Message Handling

We're still on the hook to provide a report to the Board at its January 1988 meeting. Eric Scace and I were able to meet for a few hours on July 17 at his QTH. We were successful in outlining the necessary format elements and classifying them by categories such as user, system and media-specific. Another meeting, this time including Gordon Beattie, needs to be held as soon as possible.

AX.25 Evolution

Terry Fox is past his honeymoon and moving, and advises that he will call a meeting sometime in September. We are still thinking of two steps: (1) a version 2.1 with minor fixes but still interoperable with version 2.0, and (2) a version 3.0 that accommodates reciprocal call signs and other enhancements.

Networking

The debate continues, fueled by new conference papers and results from field trials of different protocols.

Modems

Dale Heatherington's 56-kBd modem is the hot item. See his paper in the conference proceedings. Zack Lau, ARRL Lab, continues to work on a companion 220-MHz RF transverter.

Jon Bloom has laid out a PC board for A-B HF testing of the MXCom 1200-Bd MSK modem with WorldChip. As soon as the PCB is available, some stations can begin testing on 28 MHz, where 1200-Bd operation is already legal. We'll need an STA and a list of volunteer stations to test at 1200 bauds on the rest of the HF bands.

STA for HF Automatic Control

We will need to discuss what reports we need from the participating stations.

Emission Designators

I have completed a 38-page tome on this subject, which John Johnston seems to like, and will provide you with copies.

Personal Notes

Terry Fox's new address is: 7877 Hampton Village Pass, Annandale, VA 22003. Home 703-689-3721, work 202-364-3869.

The September QST cover has a picture of Toni Zimmer, KN3T, holding an antenna on Lord Howe Island, Australia. (Photo by Eric Scace)

Conference Preparation

A list of the papers to be printed in the Computer Networking Conference proceedings is enclosed. The proceedings are now at the printer, and 300 copies are being drop shipped to Harold Price's house.

Harold is holding a preconference meeting at his house on the evening before the conference to line up speaker times, etc.

73,

Paul L. Rinaldo, W4RI
Chairman

Encl. (list of conference papers)

cc: Messrs Heyn, Holladay, Quiat, Oubre, Overbeck, Shuch, Pagel

The following is a list of papers which will be included in the Proceedings of the 6th ARRL Computer Networking Conference.

"Estelle: A Formal Description Technique for Communication Protocols," Michel Berbeau, VE2BPM

"OSI: A Plan Comes Together,"
J. Gordon Beattie, Jr., N2DSY, Thomas A. Moulton, W2VY

"A High Performance Packet Switch,"
Mike Brock, WB6HHV, Franklin Antonio, N6NKF, Tom Lafluer, KA6IOA

"The KISS TNC: A Simple Host-to-TNC Communications Protocol," Mike Chepponis, K3MC, Phil Karn, KA9Q

"Digital Signaling Processing and Amateur Radio,"
Dr. Thomas A. Clark, W3IWI, Dr. Robert W. McGwier, N4HY

"A Duplex Packet Radio Repeater Approach to Layer One Efficiency,"
Robert Finch, N6CXB, Scott Avent, N6BGW

"Packet Radio Developments over the Last Year,"
Terry Fox, WB4JFI

"Thoughts on the Issues of Address Resolution and Routing in Amateur Packet Radio TCP/IP Networks,"
Bdale Garbee, N3EUA

"The Design of a Mail System for the KA9Q Internet Protocol,"
Bdale Garbee, N3EUA, Gerard van der Grinten, PA0GRI

"A Bit Error Rate Tester for Testing Digital Links,"
Steve Goode, K9NG

"A 56 Kilobaud RF Modem," Dale A. Heatherington, WA4DSY

"Reusable IP Addresses in a Dynamic Network,"
Robert B. Hoffman, N3CVL

"Software Design Issues for the PS-186 Advanced Packet Network Controller," Brian Kantor, WB6CYT

"Another Look at Authentication," Phil Karn, KA9Q

"A High Performance, Collision-Free Packet Radio Network,"
Phil Karn, KA9Q

"The KA9Q Internet (TCP/IP) Package: A Progress Report,"
Phil Karn, KA9Q

"Approach for Digital Transmission of Pictures,"
Thomas Kieselbach, DL2MDE
(translated by Don Moe, DJ0HC/KE6MN)

"RUDAK — The Packet Radio Experiment On-Board OSCAR P3C,"
Hanspeter Kuhlen, DK1YO

"Improving Shared Channel Access Techniques for Amateur
Packet Radio," Brian Lloyd, WB6RQN

"The Noise Performance of Several Data Demodulators,"
Hugo Lorente, LU4DXT

"Overview of the TEXNET datagram protocol," T.C. McDermott, N5EG

"CSMA Multihop Networks: Throughput Analysis,"
Dr. Bob W. McGwier, N4HY

"DSP Modems: It's Only Software," Dr. Robert W. McGwier, N4HY

"HF Packet: Where do we go from here?" Barry D. McLarnon, VE3JF

"FINDER--The Family Information Database for Emergency Responses,"
W.E. Moerner, WN6I, Sharon Moerner, N6MWD, David Palmer, N6KL

"Dial "0" for Operator: Message Routing in the Amateur Packet
Network," Thomas A. Moulton, W2VY

"Packet Radio and IP for the Unix Operating System,"
Clifford Neuman, N1DMM, Wayne Yamamoto

"Pacgram Messaging Protocol for Packet Networks,"
Jay Nugent, WB8TKL

"Performance Monitoring or I Wanna Fix it, Is it Broke?"
Skip Hansen, WB6YMH, Harold Price, NK6K

"ASC X12.A-1985: Draft Proposed American National
Standard for Electronic Business Data Interchange
Amateur Radio Message Transaction Set," Jack Sanders, NC4E

"Design Abstractions for Protocol Software,"
Paul Taylor, VK3BLY

amateur radio NEWS

The American Radio Relay League, Inc.

Newington, Connecticut 06111

TO: ALL MEMBERS OF THE AD HOC COMMITTEE ON
AMATEUR RADIO DIGITAL COMMUNICATIONS

SUBJECT: LOGISTICAL ARRANGEMENTS FOR NEXT MEETING

July 27, 1987

The next Digital Committee meeting will be held on August 30, 1987 at the Torrance Marriott Hotel, 3635 Fashion Way, Torrance, CA 90503-4897. The meeting will begin promptly at 8 AM. Coffee will be supplied (along with a mid-morning-break snack). There will be a break for lunch around noon-ish. The afternoon session will adjourn at 3 PM.

The 6th ARRL Computer Networking Conference is being held the day before, August 29, at the TRW Space and Technology facility. You should all have received a flyer containing directions, etc.

Reservations have been made for all committee members at the Torrance Marriott for the night(s) of August 28 and/or 29 (as specified by each member in recent phone conversations).

The committee meeting will end at 3 PM in order to allow adequate time for members to complete their return trip home. Please make every effort to return on the evening of August 30. If there is a definite problem with returning on the 30th, please contact Lori Weinberg (203) 666-1541) so further hotel arrangements can be made.

Paul is preparing a meeting notice and agenda for mailing to you in the near future.

Sincerely yours,

Lori Weinberg

Lori Weinberg
Technical Secretary

AMATEUR RADIO
NEWS RELEASE
THE AMERICAN RADIO RELAY LEAGUE, INC. ■ 225 MAIN STREET, NEWINGTON, CT 06111

July 2, 1987

For more information contact:

Paul L. Rinaldo, W4RI
ARRL HQ, 225 Main Street
Newington, CT 06111
203-666-1541

Harold Price, NK6K
1211 Ford Avenue
Redondo Beach, CA 90278
213-376-3147

ARRL Packet-Radio Conference

The Sixth ARRL Amateur Radio Networking Conference will be hosted by the TRW Amateur Radio Club and the Southern California Digital Communications Council. The conference will be held at the TRW Space and Technology facility located on Compton Boulevard (between Freeman Avenue and Aviation Boulevard), Redondo Beach, CA, on Saturday, August 29 from 9 AM to 6 PM.

The actual site is the TRW cafeteria just south of the white high-rise TRW administration. A separate dining room will be set up for demonstrations.

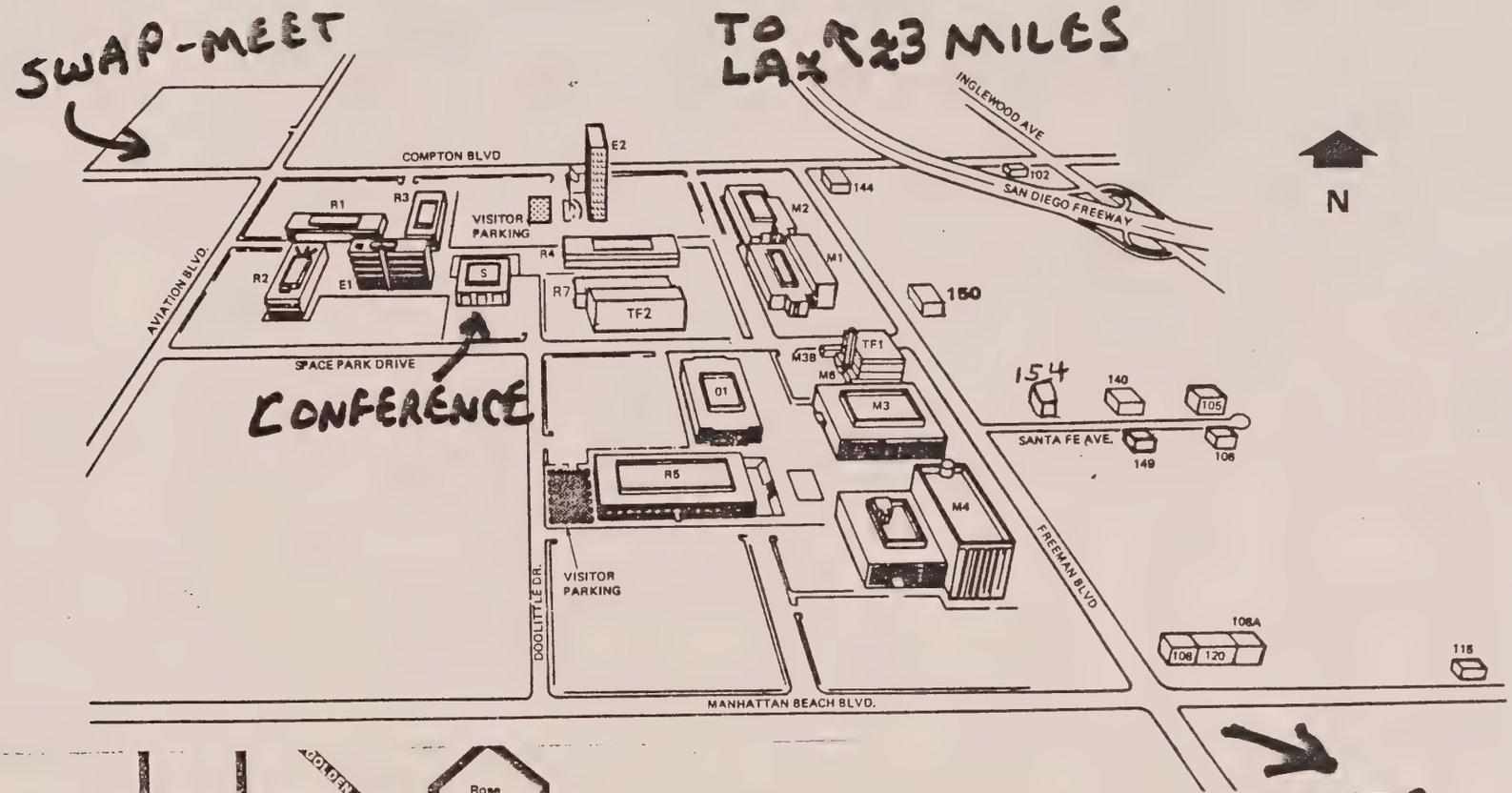
Demonstrators will be allowed to enter the facility at 8 AM for set-up. A beginners' presentation will be given at 9 AM. The main conference will start at 10 AM.

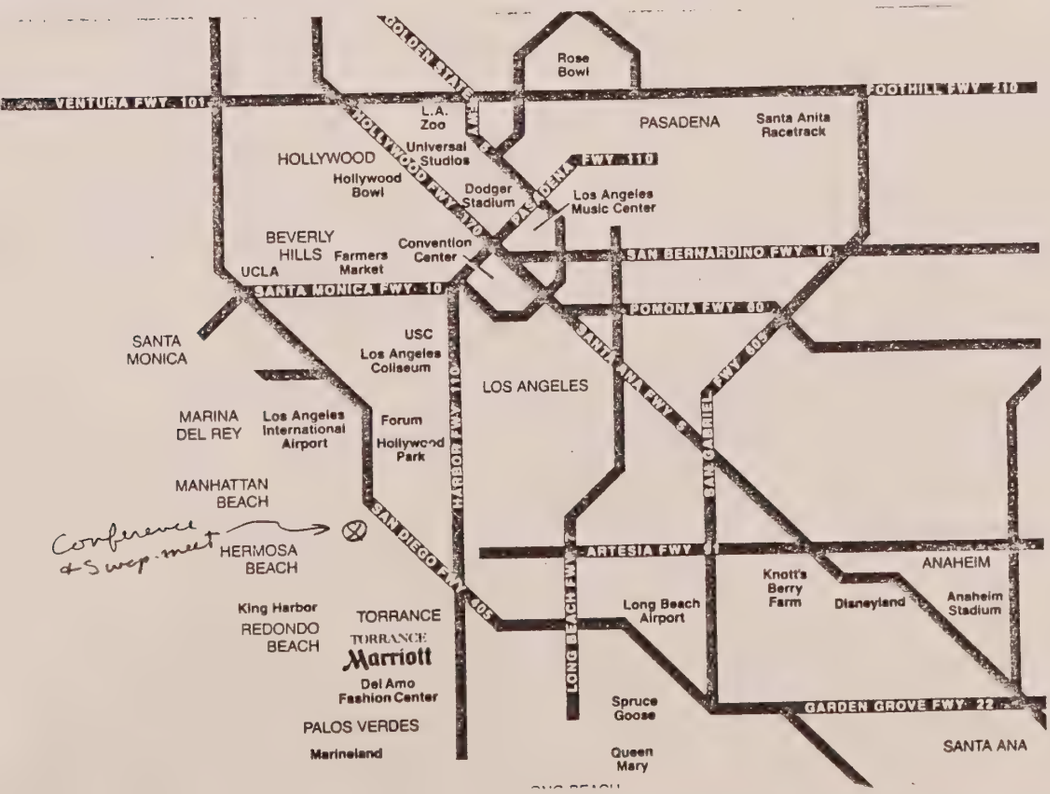
The TRW ARC swapmeet will be located about 1/4 mile from the main cafeteria. Personnel will be on hand for directions. The swapmeet starts at 7 AM and runs through the morning.

There are no commercial food establishments within walking distance; numerous eateries are within a short drive. Consider bringing a box lunch.

The official hotel for this years' conference is the Torrance Marriott, 3635 Fashion Way, Torrance, CA 90503-4897. For reservations phone: (213) 316-3636. Say your going to the Computer Networking Conference and receive the special rate of $55.00 (per night/double occupancy).

If you wish to propose any special activities for this event, please feel free to contact Wally Linstruth, 133 East De La Guerra #10, Santa Barbara, CA 93101 (805-966-6424).





THE AMERICAN RADIO RELAY LEAGUE, INC.
INTERNATIONAL SECRETARIAT OF THE INTERNATIONAL AMATEUR RADIO UNION
ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT, U.S.A. 06111

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K1LL TREASURER
203-666-1541
GENERAL MANAGER

July 2, 1987

Emile F. Alline, Jr., NE5S
Vice President, LAPRS
Box 40723
Baton Rouge, LA 70835

No. 87-5
Copies sent to all
Digital Committee members
Date: 7/3/87

Dear Emile:

Thank you for your letter, which I will share with the Digital Committee.

You make a persuasive case for getting on with network protocols. Unfortunately, there is not any unanimity which approach is best. This is not unlike the throes the commercial and government data networks are going through on the same issues. Thus, the committee chose to provide for extended field trials. It seemed for a while that testing was off to a slow start, and it was. But recent months have seen several serious pushes. I think that what's happening is that the protocol advocates are lining up their ducks for the August 29 Sixth ARRL Amateur Radio Computer Networking Conference. After that, something should shake out.

73,

Paul L. Rinaldo, W4RI
Chairman, ARRL Ad Hoc Committee on
Amateur Radio Digital Communications

cc:Stan Horzepa, WA1LOU

Louisiana Amateur Packet Radio Society

Box 40723 Baton Rouge, La. 70835

RECEIVED
ARRL
87 JUN 29 AM 10:33

23 June 1987

To: The ARRL Ad Hoc Committee on
Amateur Radio Digital Communication
Attn: Mr. Paul Rinaldo

Dear Paul,

We, The Louisiana Amateur Packet Radio Society, would like to add our support and comments to Stan Horzepa's "On Line" column in the May issue of QST. With worldwide packet communication on the horizon, we feel there is an urgent need to take what ever steps are necessary to determine what the next packet protocol will be.

Various protocols are espoused in different parts of the country and they are usually the handi-work of just one or two highly talented individuals. History has shown that after a period of time, these individuals change jobs, move, bow to family pressure, or simply "burn-out". This could be avoided if the ARRL would corral, coordinate and replenish this talent on an continuing basis. Any commercial spin-offs of such efforts could be licensed to interested parties (a'la TAPR and the TNC's).

We realize that the ARRL walks a fine line to avoid conflicts of interest or official endorsements, but in this case we feel that the various protocols can be sorted out on the basis of technical merit through careful testing. The dollar cost of such testing is very little, but the rewards would be very great.

We strongly urge the Committee to expedite testing in every way possible, as soon as possible!

Sincerely,

Emile F. Alline Jr.

Emile F. Alline Jr. NE5S
Vice President, LAPRS

cc: Stan Horzepa, WA1LOU
Clyde Hurlbert, W5CH
Al Oubre, K5DPG

No. 87-6
Copies sent to all
Digital Committee members
Date: 7/3/87

INTERNATIONAL AMATEUR RADIO UNION

Partial RESOLUTIONS to the Summary Record of the most recent meeting of the IARU Administrative Council, held in Noordwijkerhout, The Netherlands, in April

and

The Packet Radio Survey Summary

IARU
International Secretariat
P.O. Box AAA, Newington
Connecticut 06111, U.S.A.

RESOLUTION 85-7

concerning packet radio regulations

The IARU Administrative Council, Auckland, November 1985,

recognizing that the use of packet radio techniques developed in the Amateur Service is significantly enhancing the ability of radio amateurs to communicate data quickly and accurately,

recognizing that one of the techniques responsible for this enhancement is the ability to forward data through a series or network of packet radio stations, without operator intervention, and

noting that this ability adds a new and very worthwhile dimension to the capability of the Amateur Service to respond to the responsibilities for disaster communications enumerated in Resolution 640 adopted by the World Administrative Radio Conference, Geneva, 1979,

noting however, that neither the international radio regulations nor the domestic regulations of many countries were drafted with packet radio communication in mind,

resolves that the International Secretariat, in its capacity as the international clearinghouse of information relating to packet radio on behalf of the IARU, is invited:

1. to review Article 32 of the international radio regulations, and to identify for the Administrative Council the modifications that may be required to facilitate the development of the worldwide packet radio network, bearing in mind the concerns held by administrations regarding such communications;

2. to collect from member-societies information on how their domestic regulations limit or facilitate the development of packet radio, with the objective of determining what common problems may exist; and

3. to develop recommendations for Administrative Council consideration as to how these problems should be addressed, with a report to be rendered shortly prior to the next meeting of the Administrative Council.

Resolution 86-2

concerning packet radio operation

The IARU Administrative Council, Buenos Aires, October 1986,

considering 1) the increasing interest in, and rapid development of, packet radio;
2) the promise that packet radio holds for the accurate and efficient transmission of data;
3) the desirability of continuing the development of packet radio; and
4) that the popular amateur bands are already fully utilized by amateur stations using other modes of emission;

noting that the International Secretariat has been requested by the Administrative Council to serve as international clearing house for information concerning packet radio;

recognizing 1) that international and domestic regulations limit the handling of third-party traffic by amateur stations, and
2) the potential for harmful interference by unattended HF stations and the need for adequate technical and regulatory safeguards;

resolves 1) that member-societies and individual amateurs engaged in developmental work in packet radio are hereby congratulated for their contributions, and are urged to continue their efforts;
2) that member-societies are urged to encourage amateurs in their countries to confine routine HF packet operations to the segments of the bands designated for RTTY and similar modes;
3) that developmental work that takes place outside the RTTY subbands should be confined to one frequency per band, with the frequency to be designated by the International Secretariat for international communications after consultation with the regional organizations, and by the member-societies for domestic communications after due consideration of regional band plans, international and domestic regulations, and the desirability of minimizing interference to stations using other modes of emission;
4) that member-societies are urged to address, through their regional organizations, the need for specific provisions for packet radio operation in their band plans consistent with worldwide activity;
5) that the International Secretariat is requested to continue its work in response to Resolution 85-7, and if possible to render a report at least 30 days prior to the next meeting of the Administrative Council.

Resolution 87-?

concerning the relaying of messages by amateur stations

The IARU Administrative Council, Noordwijkerhout, April 1987,

recognizing the problems caused by the handling by amateur stations of communications having inappropriate content, particularly with regard to business and commercial matters,

recognizing the impact on other users of the crowded HF spectrum from unattended store-and-forward ("mailbox") stations, and

further recognizing that the problem of controlling the content of amateur radiocommunication is made more difficult by the availability of such stations,

resolves that the Administrative Council affirms the action taken at its Buenos Aires meeting, in urging member-societies to emphasize to their members the importance of adhering to the spirit and intentions of the ITU Radio Regulations, and of handling only that traffic which does conform; and

further resolves that member-societies are hereby urged to acquaint their members as to the undesirable aspects of the uncontrolled proliferation of unattended HF store-and-forward ("mailbox") stations.

P Reiland latest 1400 GMT (UTC) 15.4.87 D.

PACKET RADIO SURVEY SUMMARY - Noordwijkerhout R1 Conference - April 1987

Country	Packet Permitted	No. of amateurs in Country	Active on packet UHF	VHF	HF	% Annual Increase
		-------- General Information --------				
Austria	Yes	4,800	100-150		20-30	2-3
Belgium	Yes	4,000	50	350	20	100
Czechoslovakia	No					
Denmark	Yes	11,000	0	200	2-5	100
Faroe Is.	(Information to follow)					
France	Temporary	14,000	0	1,000	100	400
German Dem Rep	Being considered	2,781	0	0	0	--
Hungary	Yes	3,400	0	20	5	100
Ireland	(Information to follow)					
Italy	Yes	30,000	150	500	50	>200
Monaco	Yes	52	0	0	0	
Netherlands	Experimental	14,000	70	200	10	>100
Norway	Yes	3,600	5	250	50	50
Poland	(Not yet requested)					
Sweden	Yes	8,000	15	300	50	>100
UK	Yes	56,000	20	700	50	300
USA	Yes	422,082	1,000	20,000	3,000	100

	-------- Mailboxes -------			
Country	Licensed	Unlicensed	Freq.	Separate Licence Req
Austria	5	-	2m/70cm	No(club only)
Belgium	3	0	144.675	Not yet clear
Czechoslovakia				Yes
Denmark	3	0	144.650	Yes
Faroe Is.				
France	0	5	144.675/14.105	Yes(?)
German Dem Rep	0	0	--	No
Hungary	-	-	--	No
Ireland				
Italy	0	5	145.225/433.625	Yes
Monaco				
Netherlands	0	10	144.675	If unmanned
Norway	4	3	2m/20m/70cm	Registered
Poland				
Sweden	3		144.675	Yes
UK	14	10	144.650	Yes(shortly)
USA	380 linked		145.01-145.07	No

	Digipeating			
Country	OK	Regarded as 3rd party	No of Digipeaters	Separate License Req
Austria	Yes	No	2-3	If unmanned
Belgium	Yes	No	5	No rules yet
Czechoslovakia	No	No		Yes
Denmark	No	Yes/No	0	Yes
Faroe Is.				
France	?	No	12	Probably
German Dem Rep	No	--	0	No
Hungary	Yes	No	2	Yes
Ireland				
Italy	Yes	No	25	Yes
Monaco	No			
Netherlands	Yes	Under discussion	0	If unmanned
Norway	Yes	No	6	Yes
Poland				
Sweden	Yes	No	3-5	Yes
UK	Yes	No	14	No
USA	Yes	Yes	>1,000	No

	Networks					
Country	Formal?	Freq?	Auto forward?	DX forward?	Freq?	Any Non-AX.25?
Austria	No		No	No	--	No
Belgium	Yes	144.675	Yes	Yes	144.675	No
Czechoslovakia	No	--	No			
Denmark	No	--	No	No	--	No
Faroe Is.						
France	Starting	144.675	Yes	Sometimes	14.105	No
German Dem Rep	No	--	No	No	--	No
Hungary	No	--	No	No	--	No
Ireland						
Italy	Yes	433.625	Yes	Possible	--	Exp.
Monaco	No		No	No		
Netherlands	No	--	No	No	--	Exp.
Norway	Starting	70 cm	Yes	Yes	HF/VHF	TCP/IP
Poland						
Sweden	No		No	No		
UK	Yes	144.650	Yes	Not yet	--	BBC
USA	Yes	221.11/14.107	Yes	Yes	14.107	Exp.

-------- Comments --------

Country

Austria

a) Only clubstations may run mailboxes.
b) Any station may act as a digipeater if the station is manned.
c) Unmanned digipeaters have to be licensed.
d) An HF/VHF mailbox is to be set up under Society control.

Belgium

a) Packet radio was permitted as from 1.1.87.
b) There are no rules for digipeaters as yet.
c) Packet must comply with the AX25 protocol.

Chechoslovacia

a) The CRCC is working to obtain permission for packet radio.

Denmark

a) Manned digipeating is permitted.

France

a) Operation is on a temporary basis at present. Full regulations are being discussed at present.

German Democratic Republic

a) Regulations are being discussed at present.

Netherlands

a) Packet is permitted on an experimental basis while the rules are being formulated.
b) Station identification on packet is not permitted at present.

(Submitted for QST. In process of review.
Digital Committee comments requested.)

No. 87-7
Copies sent to all
Digital Committee members
Date: 7/7/87

NTS/PACKET RADIO

Donald Simon, NI6A

2327 Alva Ave

El Cerrito, CA 94530

HANDLING NTS TRAFFIC VIA PACKET RADIO

Since the dawn of radio the handling of messages accurately and speedily has been held in the highest esteem. In those very early days, the range of the average spark gap station varied from 5 miles to 10 miles. As better antenna systems, receivers, and higher power spark gap transmitters evolved, distances of 400 miles and more could be achieved as early as 1914 by the better stations operating on 200 meters and down. Obviously, longer distance communications could not be achieved reliably without relays. The American Radio Relay League was founded by Hiram P. Maxim primarily as a long distance radio relay system. By the end of 1915, over 600 stations in almost every state and province had been appointed as Official Relay Stations whose operating standards were kept very high. The technical capability for long distance relay had been present for a long time; but it was the organizational structure created by the ARRL that quickly increased the distance a message could travel from 50 miles in early 1914 to reliable transcontinental relay by February 1917. The commercial communications systems at that time were fragile and often made unusable during disasters. Thus amateur radio, even in their dawn, proved their worth to those communities which found themselves helpless without emergency communications when disaster struck.

Operation then was strictly by Morse code and suffered under the worst combinations of noise, poor receiver selectivity, frequency unstable transmitters and receivers, poor receiver sensitivity, etc. A message was handled with akin to a feeling of sacred trust by dedicated and skilled operators. A message from coast to coast often had to be painstakenly relayed 8 times or more. To "botch" or delay such a message was not looked at very kindly by "the brethren". An operator was judged not so much for the amount of messages that he could handle nor the "sweetness" of his fist as much as how accurate and reliable of a relay he proved to be. It was a high priority to have an efficient continental system established not only for amateur radio communications but for public service and disaster communications. For accuracy and efficiency, a specific format was eventually determined to be the most effective. The standard NTS format in its present form is the result of over 70 years of refining the most efficient form. It is not a coincidence that this tried and true format is in practical terms almost identical with that which also evolved in a parallel manner in the military and the commercial message services; which, by the way, were for the most part staffed by hams as well.

The present day National Traffic System (NTS) evolved out of this seventy year old public service and disaster communication tradition. The NTS is still sponsored by the American Radio Relay League and features an orderly method of reliably and responsibly moving messages across the continent on a daily basis as a public service through a system of voice and cw nets and now also packet radio forwarding systems. Packet radio forwarding, although made possible only

as recently as late 1984 appears as a natural choice to continue this fine tradition, as it is proving both accurate, fast, and more and more reliable.

NTS STRUCTURE

The NTS structure, in order to ensure reliability, is based on an hierarchy of local, section, regional, and area nets. The section and/or local net managers are appointed by the ARRL Section Traffic Manager and/or Section Manager. The Region and Area net managers are appointed by the Area Staffs The Area Staffs consist of the area and region net managers, the TCC directors, and sometimes a limited amount of members-at-large).

A message originated at the local or section level is taken to a region net by an assigned liaison station appointed by the section net manager. Likewise, traffic is taken to the area net by a liaison station appointed by the region net manager. There are three Area nets in North America; Pacific, Central, and Eastern. Traffic is transferred from area to area by members of the Transcontinental Corps (TCC) appointed by the TCC Director. Traffic then flows down from area net, to region nets and then to section and sometimes local nets where it is delivered. Thus traffic is both originated and delivered at the section and/or local net level. The rest of the NTS is simply a relay system.

Since packet radio can be viewed simply as an accurate high speed message network system it is a natural media to help facilitate the accurate and

speedy handling of NTS type messages. It should not concern the dedicated operator what the mode of transfer is rather than how fast, accurate and reliable the relay has been achieved. Because messages for the most part are still delivered in NTS section and local nets, the existing NTS format is important to maintain for reasons of interface with this important nationwide delivery, origination, and interface nets. There are literally hundreds of section and local nets meeting daily across the continent on both voice and cw that deliver third party traffic as a public service and as a training ground for the handling of formal written traffic for disaster communications. The section and particularly the local nets often form the important interface with the Amateur Radio Emergency Service (ARES). The National linked packet system will continue to evolve and become more reliable during the next few years and will prove to be a very valuable adjunct to the existing network of SSB, CW, and VHF NTS nets.

PACKET BBS MESSAGE FORWARDING

In 1984 Hank Oredson, WORLI, made available to the amateur community a free software packet radio mailbox program that ran on the inexpensive Xerox 820 computer. Soon afterwards Hank added an automatic forwarding system whereby one mailbox could automatically forward to any other mailbox at any time that would be convenient and on any radio port thus allowing for automatic relays of bulletins, personal messages, and NTS messages. This system became implemented on a widespread basis nationwide by mid 1985 through a system of VHF/H\f GateWay mailbox systems. Messages were entered on the VHF (usually 2

meter) ports and then forwarded automatically to a HF GateWay BBS for long distance relay. Traffic for closer destinations were relayed on 2 meters and later through vhf and uhf "backbone" systems. These relay systems are constantly being improved and longer distances are now being covered through coast to coast satellite links, more efficient network nodes, higher speed backbones, and a better organized national HF packet system. This system is expected to continue to increase in efficiency and reliability over the next few years.

On the West Coast this system is linked on 2 meters and 220 MHz from Texas to Oregon, to the East Coast via a high speed satellite link, and to the rest of the continent, Hawaii, and Australia via the HF GateWay mailboxes. It has been used extensively for high volume messages since mid 1985 for such events as forest fire health and welfare messages, Red Cross disaster welfare traffic, fair traffic, Christmas overload traffic, as well as normal section to section traffic relaying. It has proved a godsend for those with high volume traffic during disasters or fairs where they can dump at high speeds all of their traffic load to their closest linked packet MailBox. When propagation failed during the winter months of the low sun spot cycle, the packet vhf linked system still functioned and moved much traffic between Northern and Southern California. For years, the Sixth Region Net had great difficulty in coinciding time, frequency, and propagation into and out of Hawaii and the Pacific Section as the best time for propagation did not coincide with operators' work or life styles. The schedules with the Australian Traffic Net were only possible at midnight or 0100 West Coast time, which placed a severe strain on operators. Since Hawaii and Australia are now linked 24 hours on HF packet,

traffic so destined is automatically forwarded to certain West Coast MailBoxes who daily forward to Australia and Hawaii at prescribed times set by the MailBox system operator (sysop) sometimes when most good NTS operators are asleep.

On a section level, STMs and Net Managers are appointing Packet Net managers to facilitate the interface between the section net and the linked packet BBS system. Liaison stations are assigned to pick up the traffic at section BBS nodes to be taken to the section net. Likewise traffic outgoing from the section net is often brought to a linked packet BBS for relay via packet. The packet system is especially valuable for missed schedules, overload traffic, high volume disaster welfare traffic, fair traffic, and relay to regions where favorable propagation factors do not coincide with available operation times. The Eastern Area Staff has already appointed Region Net Packet Managers to help facilitate the traffic flow within and between their regions via packet BBS. But you don't have to be an assigned liaison station to enter traffic on packet. Anyone can just check into their local packet MailBox and drop off a NTS message as long as it is sent to a supported designator and is in standard NTS format.

NTS MESSAGE FORMAT ON PACKET

Radiogram format should follow the standard ARRL radiogram message format in order to maintain the necessary information to interface with SECTION nets, tracing originators, and essential record keeping. Delivery nets all across

the Continental USA will not accept traffic for delivery unless it is in standard NTS form:

Standard ARRL message form requires a number, station of origin, word count (check), place of origin, date and time. Give as a full an address as possible. Separate the text with a BT. End the message with the signature and the prosign AR. Sending "ctrl Z" will send the message to the mailbox.

When connected to the standard WORLI type linked BBS, the following commands should be used and the message format adhered to:

prompt >	(Note the ">" is your prompt)
ST ntsaz <cr>	
Enter title for message>	
QTC 1 Phoenix Az <cr>	
Enter text and close with a Ctl-Z (^Z):	
Nr 1 W6ABC 20 San Francisco Ca 1230Z Nov 25	(Standard nts format)
Mr George Smyth	(Addressee)
2315 North Oak St	(Give FULL address)
Phoenix Az 85040	(Include Zip as shown)
602 458 1793 BT	(Give Phone number)
	use BT to separate text
Hi Dad arrived safely at	(five words per line
San Francisco X stop over	makes it easy to

only two hours then Guam		check the word count)
X will write soon-love	BT	(give BT at end of text)
John	AR	(Use AR at end of message)

Include all helpful information in the address. If there is an apartment number or a space number (mobile parks), zip code, area code, etc be sure to include it when entering the message. Always check for typos.

Notice that the above format if stored as a file could equally be sent via Morse, RTTY, AMTOR, or packet without any need of additional editing. The "X" is the traditional "stop" and replaces a period, comma, or other punctuation. The word "query" should be spelled out for a question mark in order to prevent confusion in the word count (check) and/or procedural methods. The preamble consists of the number, station of origin, word count (also called check), place of origin, time, and date. The reasons and the fine parts of the preamble have been delineated in such ARRL publications such as the "Public Service Communications Manual", "The ARRL Field Organization", "The ARRL Net Directory", "The ARRL Operating Manual", "ARRL Message Form (CD-218), and other ARRL publications.

USE THE ACCEPTED DESIGNATORS

Use valid designators. Packet BBS are smart but can only forward messages that are sent to ACCEPTED and SUPPORTED designators. It has taken much effort by dedicated BBS operators across the USA to coordinate the automatic forwarding

of these designators.

Designator	State/Section	HF BBS	Section BBS/Section Pkt Mgr.
1st Region			
NTSCT*	Conneticut	WB1DSW,N1DL	@ K1CE
NTSMA*	Massachusetts	WB1DSW,K1BC	@ K1BC
NTSEMA	Eastern Mass	WB1DSW,K1BC	@ K1BC
NTSWMA	Western Mass	WB1DSW,K1BC	@ K1BC
NTSME*	Maine	WB1DSW,K1UGM	@ N1AHH
NTSNH*	New Hampshire	WB1DSW	
NTSRI*	Rhode Island	WB1DSW	@ N1DKF
NTSVT*	Vermont	WB1DSW,NA2B	AE1T @ KD1R-1
2nd Region			
NTSNJ*	New Jersey	W3IWI,KC2TN	
NTSENJ	East. N Jersey	W3IWI,KC2TN	
NTSNNJ	No. N Jersey	W3IWI,KC2TN	@ WA2SNA
NTSSNJ	So. N Jersey	W3IWI,KC2TN	@ KB1BD
NTSNY*	New York	W3IWI	@ WA2RKN
NTSNLI	NYC-Long Is.	W3IWI	@ W2HPM,AI2Q
NTSENY	E. New York	W3IWI	@ WA2RKN
NTSWNY	W. New York	W3IWI	@ NE2W

3rd Region

NTSDC*	Dist. of Col.	W3IWI	@ W3IWI
NTSDE*	Delaware	W3IWI	@ WB3FFV
NTSMD*	Maryland	W3IWI	@ W3IWI
NTSMDC	Maryland-DC	W3IWI	@ W3IWI
NTSPA*	Pennsylvania	AD8I,KC2TN,W3IWI	@ AG3F
NTSEPA	East Penn.	AD8I	@ KB3UD
NTSWPA	West Penn.	AD8I	@ W2XO

4th Region

NTSFL*	Florida	KOKBY,K4TKU	@ KOKBY
NTSNFL	North Fla.	KOKBY,K4TKU	
NTSSFL	South Fla.	KOKBY,K4TKU	
NTSGA*	Georgia	KI4XO	
NTSNC*	No. Carolina	W3IWI	
NTSPR*	Puerto Rico	KR5S (to KN7U NTS Voice/CW Net)	
NTSSC*	So. Carolina	WA4SZC,KI4XO	
NTSVA*	Virginia	W3IWI	
NTSVI*	Virgin Islands		
NTSWIN	(U.S. Pssns Carribean)		

5th Region

NTSAL*	Alabama	WA5DVV

NTSAR*	Arkansas		
NTSLA*	Louisiana	WA5DVV,WD5B	
NTSMS*	Mississippi	WA5DVV	
NTSOK*	Oklahoma	WD5B	
NTSTN*	Tennessee	KI4XO,WD5B	
NTSTX*	Texas	W5XO,WA5QZI	
NTSNTX	North Texas	W5XO,WA5QZI	
NTSSTX	South Texas	W5XO,WA5QZI	
NTSWTX	West Texas	W5XO,WA5QZI	

6th Region

NTSCA*	California	WB6KAJ,KD6SQ,WORLI,N4CHV, KB6IRS,KE6BX,W6CUS	NI6A @ W6CUS
NTSSDG	San Diego	WB6KAJ,KD6SQ,KR5S	N4KRA @ NK6K
NTSSB	Santa Barbara	WB6KAJ,WORLI,N4CHV,KD6SQ	WA6MBZ @ W6IXU
NTSORA	Orange	WB6KAJ,KD6SQ,KR5S,WORLI	WF6O @ W6IXU
NTSLAX	Los Angeles	WB6KAJ,KD6SQ,KR5S,WORLI	WF6O @ W6IXU
NTSEB	East Bay	W6CUS,WORLI,N4CHV,KB6IRS,KE6BX	NI6A @ W6CUS
NTSSCV	Sta Clara Vly	WORLI,N4CHV,KE6BX,KB6IRS,W6CUS	NI6A @ W6CUS
NTSSJV	Sn Jacquin Vly	WORLI,N4CHV,KE6BX,KB6IRS,W6CUS	NI6A @ W6CUS
NTSSV	Sacto. Vly	WORLI,N4CHV,KB6IRS,KE6BX,W6CUS	N6LAM @ WD6BFC
NTSNV*	Nevada	KR5S,N5EDH,K7PYK,K7BUC	@ KV7H, WB5PTO @ WB7BNI
NTSHI*	Hawaii	KH6WY	
NTSPAC	HI & Pac. Psns.	KH6WY	

7th Region

NTSAB*	Alberta		
NTSAK*	Alaska	WB7DCH (To KL7GNG)	KL7GNG
NTSBC*	British Col.	WB7DCH,KE7OM	
NTSID*	Idaho	KE7OM	
NTSMT*	Montana		
NTSOR*	Oregon	WB7DCH,KE7OM,K7IFG	K7IFG
NTSWA*	Washington	KE7OM,WB7DCH	KD7ME @ KE7OM
NTSYU*	Yukon		

8th Region

NTSOH*	Ohio	AD8I,W9ZRX
NTSMI*	Michigan	VE3GYQ,W9ZRX
NTSWV*	West Virginia	AD8I,W3IWI

9th Region

NTSIL*	Illinois	W9ZRX,WD9DHI
NTSIN*	Indiana	W9ZRX,AD8I
NTSKY*	Kentucky	AD8I,W9ZRX
NTSWI*	Wisconsin	WD9DHI,WA0CQG

10th Region Net

NTSIA*	Iowa	WA0CQG	
NTSKS*	Kansas		
NTSMB*	Manitoba	VE4AFO	
NTSMN*	Minnesota	WA0CQG	
NTSMO*	Missouri		
NTSND*	North Dakota	WA0CQG	
NTSNE*	Nebraska		
NTSSD*	South Dakota	WA0CQG	
NTSSK*	Saskatchewan		

Eleventh Region Net (Eastern Canada)

NTSLB*	Labrador		
NTSMRN	Maritime-Nfld		
NTSNB*	New Brunswick		
NTSNF*	New Foundland		
NTSNS*	Nova Scotia		
NTSON*	Ontario	VE3GYQ,AD8I	
NTSPE*	Prince Edward		
NTSPQ*	Prov. Quebec	NA2B	@ VE3PAK

12th Region Net

NTSAZ*	Arizona	KR5S,N5EDH,K7PYK,K7BUC,KE7CZ	KR5S @ KR5S,WB7BNI
NTSCO*	Colorado	W1HAB,K0HOA	
NTSNM*	New Mexico	KN5D	KN5D @ KN5D

NTSUT*	UTAH	KR5S,K7PYK,W1HAB,
NTSWY*	Wyoming	KOHOA

* Denotes STATE/PROVINCE standard postal abbreviations as per ARRL official Net directory.

The ARRL Section abbreviations are mostly standard contest abbreviations. Section and local net packet designator abbreviations can be customised within the region according to local needs.

****IMPORTANT****

Traffic should be sent to the STATE/PROVINCE designators (those marked with an asterisk) unless the traffic is going WITHIN the region AND the SECTION designator is coordinated and supported. Thus BBS sysops need only support the designators marked with asterisks plus the special designators within your region. In WestNet special designators are supported in addition to those above:

NCN	W6CUS
NCNSAC	WD6BFC
SCN	W6IXU
SCNSB	W6IXU
SCNSD	NK6K
RN6	W6CUS

For more information on NCN and SCN boundaries see CALNVNET.NTS. For more

information on how to handle NTS traffic read HOWTO.NTS. Both these files can be found on most WestNet BBS.

Please notice that there is no packet NTS outlet yet to the following states and provinces:

VIRGIN ISLANDS, ARKANSAS, ALBERTA, MONTANA, YUKON, KANSAS, MISOURI, NEBRASKA, SASKATCHEWAN, LABRADOR, NEW BRUNSWICK, NEW FOUNDLAND, NOVA SCOTIA, ONTARIO, PRINCE EDWARD, and QUEBEC.

If the State/Province is not supported by a BBS, then it cannot be handled by the national packet system at this time. Such traffic can be sent to RN6 thusly: ST RN6 and will be picked up by NTS liaison stations at W6CUS-1 and put on the regular NTS CW and SSB Nets.

NTS traffic should always be sent with the "ST" command so that it can be deleted with the "KT" command. Some examples:

ST NTSMA or

ST NTSOH or

ST NTSTX

etc

DO NOT ENTER @ MAILBOX CALLSIGN. Traffic will be routed automatically by designator by the BBS. The mailbox callsigns are listed only for the benefit of reference for BBS sysops.

Examples: ST NTSNY

ST NTSFL

ST NTSIL

CALIFORNIA DESIGNATORS

Traffic originated nationally sent to "NTSCA" will arrive at w0rli, kd6sq, kb6irs, ke6bx, n4chv, and w6cus HF GateWays. Such GateWay stations may automatically send such traffic toward W6CUS-1 for sorting into specific California designators if they can not resort into the California sub-designators.

PACKET BBS NTS OPERATING PROCEDURES

Remember to use the "T" in the "ST" command or your message will not be able to be killed with the "KT" command at the end point. When you check into a mailbox type "LT" to get a list of NTS traffic. If you can deliver any, type "R Number" and after making sure you have 100 % copy, delete the message. To kill (delete) NTS traffic use the "KT" command followed by the message number. *Do so only after you are sure you have confirmed copy*. This erases the message so it won't be delivered twice. On some systems it also services a message back to the originator that the message has been picked up and by whom and when.

NTS/PACKET RADIO by NI6A

Amateurs are encouraged to use the NTS frequently - the experience will be fun and your friends will appreciate hearing from you ---but, most important, the experience will also give you training for emergency communications (which all Amateurs should be able to work with when the occasion demands--- Mexico City, etc.)

UNBUNDLE YOUR MESSAGES

If you have more than one message even if they are going to the same state or section, please send them as individual packet BBS messages. Please remember that traffic eventually will have to be broken down to the individual addressee somewhere down the line for ultimate delivery. When the originator places two or more NTS messages destined for different addresses within one packet message, eventually the routing will require the message to be broken up by either the bbs sysop or the relay station; placing an additional unreasonable burden being on them both. Therefore it is suggested that the originator to expend the extra word processing in the first place and create individual messages per city regardless if there are common parts with other messages. This means that book messages are not suitable in packet at this time unless they are going to the same city.

THIRD PARTY COUNTRY LIMITATIONS

The FCC limits our ability to engage in third party traffic with foreign nations. Currently third party traffic is permitted with Antigua , Barbuda, Belize, Canada, Costa Rica, Cuba, Cyprus, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, St. Christopher, Nevis, St. Lucia, St. Vincent, Argentina, Bolivia, Brazil, Chile, Columbia, Ecudor, Guyana, Paraguay, Peru, Trinidad, Tobago, Uraguay, Venezuela, Geneva (4U1ITU), Israel, Jordan, Ghana, Liberia, The Gambia, Swaziland, Australia, Pitcairn Island. These agreements are constantly changing and "QST" magazine publishes the updates regularly.

STARVATION

There have been some fears expressed by some uninformed "oldtimers" about the packet system "starving" out the present NTS HF system. If these negative naysayers would spend the time to really evaluate packet networks fairly, they would see more than just a threat of efficiency and accuracy. They would realise that just as the Daytime SSB cycle two system which was inaugurated in the late sixties did not starve out the NTS CW nets, neither will the packet system. The CW nets suffer from lack of participation at the section level and competent liaison and TCC CW operators. Its' problems can not be blamed on packet. Packet will provide not only the accuracy and speed but also the flexibility and redundency that the NTS most certainly requires.

The heart of the NTS is with the hard working Section Net Manager whose mostly thankless job is to provide delivery coverage throughout his

section and also to appoint daily liaison stations to and from the region cw net, to and from the region SSB net, net control stations for each session plus usually a slow speed session. Many section nets now have a VHF session as well. If that wasn't enough, he or she often doubles as newsletter editor. On top of all that the Section Net Manager is supposed to formulate a method of handling disaster traffic into and out of the section net and also to file monthly reports with the ARRL headquarters. This job requires help and the smart Net Manager delegates responsibilties as much as he or she can.

In overload conditions, disasters, missed liaison schedules, etc net managers have sent the traffic out using the national packet system and rightly so if our concern here is in "getting the message through". This has been most widely appreciated during the recent low sun spot cycle in the winter months when short skip conditions within the section and also within the region were made impossible sometimes for weeks at a time. Liaison stations willing to take traffic to the region CW net are also getting scarce especially on the vhf nets. In such cases taking the traffic to the linked packet BBS system has speeded up the eventual delivery and seems to be the more efficient method. What has happened in certain vhf section nets, the section net managers will appoint liaison on a primary basis with a section packet liaison station either daily or on certain designated days where no cw region net liaison station is available. Such traffic is dumped that same evening at the operator's convenience onto the local linked packet MailBox thus not requiring the liaison station any inconvenience of poor conditions, difficult time schedules, having to cope with sloppy fists, etc. It has been shown that the traffic so moved via packet BBs gets delivered as soon or sooner than traffic

sent via the normal CW or SSB networks. During overload conditions, when the CW region liaison station is overloaded or otherwise incapable of handling all the outgoing traffic; overload messages can be most efficiently handled by the packet liaison station. This way there should be no starvation to the existing system. In any case such matters of liaison should be left to section net manager as his is the task that is the hardest of all and whose authority must be respected in these matters.

In Northern California, the net manager for Northern California Net, N6AWH, has appointed a section packet net manager to ensure that there is interface from the national packet network in and out of Northern California Net. An additional advantage of the linked packet system is that of extended coverage of most section vhf nets because of ability of packet digipeaters and BBS to link on the same simplex frequency. This allows stations who were not otherwise able to participate with the NTS the added ability to originate and deliver messages using packet; thus more traffic can flow in the system than ever before.

Packet is too young for anyone who understands the NTS to advocate the disolution of the existing SSB and CW HF nets. On the contrary, it will be many years before there is enough reliability and redundency in the packet network to be able for us as a system to rely on packet as a self contained relay system and even then; it would be unwise for us to totally rely on packet because during disasters, it will be the packet systems that would be more subject to fragility than the cw or ssb systems. It would be more appropriate for us to think in terms of parallel systems not in divisive or

competitive terms but as different means toward that same end of reliability through flexible and redundent systems. The wise Section Net Manager will continue to keep open as many outlets and pathways as he/she can and pay particular attention in order not to starve out any one.

FUTURE DESIGNATORS

About a year ago there was a lively debate on the Compuserve HamNet section on NTS designators. General consensus was that zip codes may be ideal only if ranges or wild cards could be supported. I see that the debate has recently sprung up again. Some have suggested using grid squares, area codes, zip codes, or simply the state designator without the letters, nts, in front. Many of these suggestions have merit.

Grid squares is too esoteric. Without expensive and specialized maps, it would be very difficult to locate the correct grid square for small towns across the continent. Likewise area codes would also make the user interface more difficult as how do we find the area codes for small towns? They are not listed in phone directories and on maps. This would slow down the entering of the data and make the user interface much more complicated. Also area codes are not arranged chronologically in relation to geography; therefore using wild cards with area codes would be worthless. Contrary to wishful thinking less than half the messages presently on NTS contain area codes. Finally, area codes are not exact enough, they often include more than one ARRL Section and Division. For example the area code of 805 covers parts of both the Pacific

Division (SCV section) and the Southwestern Division (Santa Barbara Section).

Using just the state/province abbreviations without the "nts" in front is a good idea and is more efficient; but this has not yet been supported. Zip codes are the best choice as far as most can see once the matter is discussed. They can be very specific (therefore requiring less sysop manual interface). They are easily available (everyone has an address and therefore easily obtained zip code) but not everyone has a telephone or obtainable area code without requiring a telephone call to the operator). If you don't know the zip code, it can be easily looked up in any postal zipcode book. It's available in the callbook (area codes are not). It's capable of specific routing (5 digit delineation). Previously it was not feasible for BBS sysops to support zip codes because of the burden for sysops to have to enter all zip code possibilities line by line into their forwarding tables; but now that WORLI has issued his version 3.0 which supports wild card routing, this possibility is now more practical and allows maximum flexibility. How this will work out for the Canadian provinces is not yet clear as they have a different zip code system.

A sample of the forwarding file at W6CUS-1 may look something like this if and when this system becomes supported by the national HF GateWay system.

92*

930*

931*

93214

93234

93254

934*

93510

93514

93522

93526

93530

93532

*** EOF

GC0023C WA6RDH v WA6RDH-11

955*

956*

957*

958*

959*

960*

*** EOF

GB0114C K7PYK

961*

8*

*** EOF

GB0114C KE7OM

97*

98*

*** EOF

Notice that this zip code routing system will not eliminate the great effort required by HF sysops but may be of aid. Only time and experimentation will tell. In anycase, no new designators should be used other than the "ntsxx" system until coordination and support is widespread. Otherwise the traffic will just be lost or delayed. The bottom line has been and will continue to be that the designators that are supported by the HF GateWays will be the only ones that will work and all changes must be first cleared with them. If this system becomes too burdensome to the HF sysop then we must support another one.

THE FUTURE OF PACKET MAIL

Packet is continuing to grow. There is today temporary overcrowding in certain areas, sporadic service due to the lack of redundency of key digipeaters, and other sources of delays. But this is all temporary as packet has not even come close to realise its' potential. High speed vhf and uhf backbones are being planned for in almost every part of the country. More efficient network nodes are being installed on a widespread basis. An ARRL Special Temporary Authorization with the FCC has just been applied for in an attempt to prove the concept of automatic forwarding on HF, but more important there are more exciting things ahead in this frontier than this in regards to the NTS.

FTP is perhaps the most likely candidate to take over the message forwarding

system in the long future. It is a standard message forwarding protocol used by commercial networks running TCP/IP. It appears that there is still some debate over whether TCP/IP will be successfully integrated in the national packet system and whether FTP will be the accepted standard adaptation. However if it will be FTP or something even better, most do not debate that national, error free message service coast to coast within the matter of minutes should be available via amateur packet networks by 1991. But this will take much effort by the packet pioneers of today who are busy modifying radios, writing code, securing high level node sites, building high speed affordable modems, and attempting to coordinate national compatability before any type of reliable national networking can occur. We must be watchful that such a network not only serves amateur to amateur communications needs but also third party abilities for both NTS traffic and disaster agencies.

FURTHER REFERENCES

The following files are found on most WestNet BBS:

CalNvnet.NTS : A list of all the NTS section nets in California and Nevada and the breakdown of section boundaries. Please note that the May 1986 issue has the incorrect time for SCN. SCN begins at 1830 local time not 1900 local.

Desig.NTS : A list of the up-to-date valid designators that are supported by the packet system at this time. This list is periodically

updated. Please note there are still a few states and provinces that are not yet interfaced with packet and thus should not be used at this time.

The above files may be under different names on your BBS. Ask your sysop. More info to NI6A @ W6CUS.

Further information on NTS can be obtained from your local Section Traffic Manager or the ARRL, 225 Main St. Newington, CT 06111, especially;

"The Public Service Communications Manual"

"CD-218" (Net procedure, abbreviation, and message format aid)

"The ARRL Field Organization" (FSD 300)

"The ARRL Net Directory" $1.00 (FSD 50)

"The ARRL Field Resources Directory"

"The ARRL Operating Manual", $6.00

Donald Simon, NI6A, @ W6CUS

Section Packet Net Manager, Northern California Net.

Communications Chair. Am. Red Cross, Berkeley/West Contra Costa Chapt.

Sysop W6CUS-1 HF/ GatewWay MailBox, Northern California's Oldest HF GateWay.

(6-12-87)

THE AMERICAN RADIO RELAY LEAGUE, INC.

ADMINISTRATIVE HEADQUARTERS NEWINGTON, CONNECTICUT

WILLIAM J. STEVENS
DAVID SUMNER
PERRY WILLIAMS
JAMES E. McCOBB

No. 87-8
Copies sent to all
Digital Committee members
Date:

July 7, 1987

Gene Pentecost, KG6EX
2017 Cedarmont Drive
Franklin, TN 37064

Dear Gene:

Your letter was particularly welcome on several counts. One is that it offers some hope of clinical, as opposed to anecdotal, research on characterizing the HF medium for data transmission. Another is that we need to develop a means of cooperative R&D involving Amateur Radio experimenters, industry, government and universities.

My review of the technical literature shows that much is known about the characteristics of the ionospheric medium in larger time chunks. However, I have found little on the behavior of the medium in periods of 3 seconds or less, an understanding of which is crucial to optimizing HF packet modems. After all, it take just one bit error to make the FCS not check. When we are dealing with a noncoherent bandwidth, as in the presence of selective fading, there is usually a considerable amount of energy somewhere in the passband that could be used for successful demodulation. Unfortunately, current modems tend to destructively combine the energy that's there if it's not in the right phase. Besides modems, there is considerable post-demodulation processing that could be done in a smarter TNC. For example, if there are one or more weak bits, flipping them on successive tries could produce a good frame. Of course, there's another whole area of investigation for error-mitigation protocols (ARQ, FEC, hybrids thereof, diversity, etc.). There is unquestionably a rich academic playpen here. The good thing, of course, is that all of it has immediate practical value.

On the subject of Amateur Radio experimenters, universities and others doing some cooperative R&D, some of my thoughts are contained in the enclosed item "On Hatching Incubators" that appeared in the April, 1987 issue of **QEX**. What potential for such cooperation do you have in your locale? How can we best network these centers located in different parts of the country?

73,

Paul L. Rinaldo, W4RI
Chairman, Ad Hoc Committee on
Amateur Radio Digital Communication

pp

RECEIVED
87 JUL -2 AM 9:26

2017 Cedarmont Drive
Franklin, TN 37064
25 June 87

Chairman, ARRL Ad Hoc Committee on
Amateur Radio Digital Communications
c/o ARRL HQ
225 Main Street
Newington, CT 06111

Dear Sir:

I am writing in response to the article "Standards Alternatives for HF Packet Modems," QEX, June 1987.

After 35 years in the electronics industry, I entered active retirement about 18 months ago. I am a Research Professor of Electrical Engineering at Vanderbilt University, School of Engineering. One of my projects is to revive the ham club which has been dormant since the death of its faculty advisor about five years ago. The Dean and I want it to contribute to the educational process as well to be a recognized student activity.

One of the projects in mind was a study of HF propagation characteristics as they relate to digital communications. I believe packet is the avenue for the modern student to enjoy ham radio. With that in mind consider the following program:

1. Selected universities with ham clubs from around the world would participate in communications experiments to yield data on HF digital propagation characteristics. Various modem mechanizations would be evaluated.

2. One university would be designated lead to coordinate the activity. The ARRL would the agency responsible for dissemination of the results. The program could begin with as few as three universities.

3. Each university would be responsible for its own funding. Joining the activity would require a commitment from the School.

4. The lead university would be responsible for proposals to obtain external funding. (Some care would be required in order to preserve the amateur status of the program.)

The following points are important:

1. Students are smart, dedicated, and turn out a lot of work when motivated.

2. The universities gain by having students work on a real hardware problem.

3. The study involves disciplines of current interest to the University community; ie, communications and digital signal processing.

4. The ARRL would be the liaison with the FCC.

5. Because the University's name would be associated with the result, the faculty would make sure the studies are academically sound.

6. It would be a significant positive step toward exposing our young professionals to Amateur Radio.

My amateur radio interests go back to the early 1940s. After many years of inactivity, I returned to the ranks about three years ago. At my home QTH where I moved after retirement, I have just finished my antenna system: a 56 ft. Rohn self supporting tower with a TH5 tribander, KLM 2M-14C and KLM 435-18C. A KENPRO KR-5600A furnishes appropriate azimuth and elevation control.

The shack is equipped with Kenwood TS-811A, TS-711A, TS-430S, MFJ 1270, IBM PC, printer, etc. I have ordered an FO-12 modem from TAPR. In the near future I will add an AEA PK-232. I am interested in personally participating in modem experiments.

If there is sufficient interest in pursuing the University program, possibly we could set up a time and frequency for a rag-chew among the interested parties.

73

Gene Pentecost, KG6EX

Bill Wade, WD5HJP
600 Via Sevilla
Mesquite, Texas 75150
(214) 686-1341, weekends or 10AM to 3PM weekdays

June 28, 1987

No. 87-9
Copies sent to all
Digital Committee members
Date: 7/7/87

87 JUL -6 PM 1:16

Guys:

This letter is in lieu of a phone call to each of you. I'm having to go cold-turkey from my phone addiction! The bills are outrageous and all of you know my motor-mouth!

News:
(guess he's talking about TexNet/PR)
We are now a 501(c)(3), income tax exempt, non-profit corporation. That means we can accept donations of equipment, cash and other non-perishables! We got our notification from the IRS last week.

The NCP version 2.1 (Node Control Processor) pc board layout has been checked. Tom & I went through the checkplot Sunday. He will fix the minor errors we caught Monday (tonight). I'll send the disks with the plots to Lyle Johnson to be plotted as 2X artwork and we'll have that back Friday. Over the weekend, a drill plot will be done by Tom. The week of July 5th, the artwork goes to the manufacturer. We will order 5 boards, I'll build one, Tom will test it. After we've tested the first one and its pronounced ok, we'll take orders for the first regular production run of pc boards. We'll have the other 4 boards to sell immediately, one each, to the San Antonio, Austin, Houston and Rockport groups to be built.

We will be having 3 events of interest happen at the summer Texas VHF-FM Society Convention. That's August 8th and 9th, Austin, the Villa Capri hotel, 26th Street and I-35. No times yet for any of the meetings. The Villa Capri is visible from the highway. When coming from out of town, stay in the second-from-the-left lane of I-45. The right 2 lanes do not exit to 26th Street. That goes for either north or South bound I-45.

The first meeting will be a seminar for the general amateur operator about the basics of TexNet. Most of you have seen it already at HamCom or at the winter meeting or at the special McDermott/Aschenbrenner Dallas meeting.

A lunch meeting at a site yet to be determined. This will be the general membership meeting. We'll make some announcements, take care of some regular business and chow down.

The third meeting is the important one. We need to get the Austin, San Antonio, Rockport and Houston area groups thinking on same wavelengths about these issues:
1> Coordination of the network structure
  a> What 2 meter frequencies as user ports in each city
  b> At what sites should the nodes stay off 145.01?
  c> Frequency agility of user ports

d> 220 access frequencies
e> Digipeat limits input and output of nodes
f> Conference bridge sites independent of TexNet nodes
g> Nodes as digipeaters

2> Alternative branches to TexNet
a> Skinny-Net
b> Secondary branches at slower speeds
c> NetRom and other system compatibilties

3> Network administration
a> Who coordinates Node numbers and nodenames
b> Stats analysis
c> resolution of issues outside of technical standards
d> emergency exercises and liason with RACES and ARES
e> network useage
f> site restrictions due to the charter purpose of TPRS
g> Control point access and secondary services to other systems
h> Multiple PMS'
i> Inter-Net connections, ie other privately owned TexNet-like systems or NetRom systems

4> Technical issues
1) Antennas
A) Why horizontal
B) Specs for gain
C) Power splitter
D) Omni-directionals with gain
E) Second sources
F) 2 meter antennas
2) Radios
A) Modifications to 700's
B) A second type of network 445.1 radio
C) Reliable 2 meter radios, small size
3) Power supplies
A) Why a UPS
B) Gel-cells vs Lead-Acid
C) Special AC line conditioning

If you have any other issues you want discussed at either of the two meetings, please send them to me.

73,

Bill

American Radio Relay League
225 Main Street
Newington, CT 06111

A Working Paper On:

Designation of Emissions in the Amateur Service

Paul L. Rinaldo, W4RI

August 1987

DESIGNATION OF EMISSIONS IN THE AMATEUR SERVICE

by

Paul L. Rinaldo, W4RI*

August 1987

American Radio Relay League
225 Main Street
Newington, CT 06111

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* The opinions and conclusions expressed in this report are those of the author. They do not necessarily reflect the policies of the American Radio Relay League or any other organization. The author wishes to acknowledge the cooperation of John B. Johnston, W3BE, Chief, Personal Radio Branch, Special Services Division, Federal Communications Commission, in reviewing this subject and discussing its possible impact on Part 97 of the Commission's Rules.

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ABBREVIATIONS AND ACRONYMS

AFSK - Audio-Frequency-Shift Keying

ASCII - American National Standard Code for Information Interchange

ASK - Amplitude-Shift Keying (variant of OOK)

baud - A unit of signaling speed equal to the number of discrete conditions or events per second.

DSP - Digital Signal Processing

CCIR - International Radio Consultative Committee

CCITT - International Telegraph and Telephone Consultative Committee

CW - Continuous Wave (usually, on/off-keyed Morse telegraphy)

DSP - Digital Signal Processing

FAX - Facsimile

FCC - Federal Communications Commission

FM - Frequency Modulation

FSK - Frequency-Shift Keying

Hz - Hertz (cycles per second)

ITA2 - International Telegraph Alphabet No. 2

ITU - International Telecommunication Union

kbit/s - Kilobits per second

kHz - Kilohertz

MCW - Modulated CW (usually, on/off-keyed Morse telegraphy with tone modulation of the carrier)

MHz - Megahertz

NB-DP - Narrow-Band Direct-Printing (radioteletype)

NBFM - Narrow-Band Frequency Modulation

OOK - On/Off Keying

Phone - Radiotelephony

ABBREVIATIONS AND ACRONYMS
(continued)

SSB - Single Sideband

SSTV - Slow-Scan Television

RTTY - Radioteletype

WARC - World Administrative Radio Conference

WPM - Words per Minute

SUMMARY

Emission designators have grown in number and specificity to the point where their continued use in the amateur service has become a disadvantage. In the implementation of new emission designators adopted at the 1979 World Administrative Radio Conference brought the number of emission designators used in the amateur rules from 14 to a choice of 1296 if all combinations were used. Only a few of the possible emission designators were written into the amateur rules effective January 1, 1985. Others have been added by subsequent rule changes, and many more would be needed to cover all emissions in actual use and others for likely and desirable experimentation in coming years.

This paper traces the history of emission designators and concludes that the post-1979 WARC emission designators have proven to be unsuitable for authorizing emissions in the amateur service. A more flexible method of authorizing emissions is needed to encourage amateurs to experiment with spectrally conservative modulation methods, and to provide immediate use without the administrative burden and delay involved with petitions for special temporary authority or rule making.

Alternative methods of designating emissions are discussed, and a conclusion is reached that emissions in the amateur service should be specified by selected English words and abbreviations. To the extent possible, these designations should specify permissible types of information rather than particular modulation techniques, which should be left to experimentation and evolutionary change.

DESIGNATION OF EMISSIONS IN THE AMATEUR SERVICE

I. Introduction

Emission designators have evolved from a simple system in place in the 1930s to a complex system in the post-1979 WARC period. To a degree, the additional refinements were needed for purposes of describing an ever-growing number of emissions in various radio services. Also, monitoring stations needed a classification system specific enough to determine whether on-the-air activity was in accordance with what was authorized. In most respects, the post-1979 WARC emission designator system meets those basic needs. Nevertheless, the present system has some anomalies, which will be detailed later.

Part 97 of the Commission's rules has followed the trend toward greater complexity in authorizing emissions. This report traces major changes since the early 1930s. There were problems in the translation from pre-1979 WARC to post-1979 WARC designators as there were no one-to-one correspondences in some cases.

In a deregulatory atmosphere over the past decade, rather than becoming more relaxed, amateur service rules have become more detailed and longer, particularly with regard to authorized emissions. It is reasonable to question whether this is the right direction for a service with experimental missions outlined in paragraphs 97.1(b) and (c), as follows:

> (b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.
>
> (c) Encouragement and improvement of the amateur radio service through rules which provide for advancing skills in both the communication and technical phases of the art.

Now is the appropriate time to review and revise the method of specifying permissible emissions in the amateur service. The selected method should support, not impede, the evolution of new transmission techniques. What is permissible and what is not should be understandable even to those preparing for the Novice class license.

This study outlines the changes in emission designator systems over the past six decades, discusses inherent problems, and proposes an alternative that will encourage exploitation of new communication technologies.

II. Evolution of ITU and FCC Emission Designators

A. 1932 General Radiocommunication Regulations

Article 5 of the General Radiocommunication Regulations, Madrid, 1932, read as follows:

Classification of emissions.

1. Emissions are divided into two classes:

A. Continuous waves,

B. Damped waves, defined as follows:

Class A: Waves of which the sucessive oscillations are identical when the steady state is reached.

Class B: Waves consisting of successive series of oscillations of which the amplitude, after having reached a maximum decreases gradually.

2. Class A includes waves of the following types:

Type A1. Continuous waves of which the amplitude or frequency is varied by telegraphic manipulation.

Type A2. Continuous waves of which the amplitude or frequency is varied in accordance with a periodic law at audible frequency, combined with telegraphic manipulation.

Type A3. Continuous waves of which the amplitude or frequency is varied in accordance with a complex and variable law at audible frequency. Radiotelephony is an example of this type.

Type A4. Continuous waves of which the amplitude or frequency is varied in accordance with any frequency law at supersonic frequencies. Television is an example of this type.

B. 1947 Radio Regulations

Article 2 of the Radio Regulations adopted at the International Telecommunication and Radio Conferences, Atlantic City, 1947, specified the designation of emissions as follows:

Section I. Classification

Emissions are classified and symbolized according to the following characteristics:

(1) Type of modulation
(2) Type of transmission
(3) Supplementary characteristics.

(1) Types of modulation:	Symbol
a) Amplitude	A
b) Frequency (or phase)	F
c) Pulse	P

(2) Types of transmission:	
a) Absence of any modulation intended to carry information	0
b) Telegraphy without the use of modulating audio frequency	1
c) Telegraphy by the keying of a modulating audio frequency or audio frequencies or by the keying of the modulated emission (special case: an unkeyed modulated emission)	2
d) Telephony	3
e) Facsimile	4
f) Television	5
g) Composite transmissions and cases not covered by the above	9

(3) Supplementary characteristics	
a) Double sideband, full carrier	(none)
b) Single sideband, reduced carrier	a
c) Two independent sidebands, reduced carrier	b
d) Other emissions, reduced carrier	c
e) Pulse, amplitude modulated	d
f) Pulse, width modulated	e
g) Pulse, phase (or position) modulated	f

Note: As an exception to the above principles, damped waves are designated by	B

C. 1959 Radio Regulations

The Radio Regulations of the International Telecommunication Union, Geneva, 1959, extended the 1947 designation of emissions by adding the following:

Types of transmission	Symbol
Four-frequency diplex telegraphy	6
Multichannel voice-frequency telegraphy	7

Supplementary characteristics: (now upper case)	
Coded pulses (after sampling and quantization)	G
Single sideband, full carrier	H
Single sideband, suppressed carrier	J

D. 1963 CCIR Proposal

Report 175 printed in Volume I of the documents of the plenary assembly, Geneva, 1963, reviewed certain aspects of classification and designation of emissions. It stated:

> The object of describing different emissions by appropriate symbols is to give the user, in a summarized form, an adequate knowledge of:
>
> -- the characteristics of the modulations and multiplexing,
>
> -- the type of modulating signal conveying the information.

It went on to state:

> To facilitate handling of the data by an electronic or mechanical process, an essential prerequisite for a modern system, the method of symbolization should give the same number of code characters for any emission. Thus, according to such a system, in the symbol group designating any emission, the position of any individual character within the group would immediately indicate what aspect of the emission it described. At the same time, the number of character-symbols necessary to define any emission should be as small as possible.

The Report proposed a two-letter system where the first letter indicated the "characteristics of the modulations and multiplexing," and the second letter the "characteristics of the modulating signal." Annex II of the Report contained a detailed, if not exhaustive, list of characteristics considered to be essential for the purpose of classification.

By 1963, it was clear that CCIR thinking favored brief symbols, suitable for data processing and listing in the Master International Frequency Register, that would give a specific definition of modulation and multiplexing.

E. 1966 CCIR Recommendation

Recommendation 432, Volume 1 of the documents of the plenary assembly, Oslo, 1966, replaced Report 175 and further refined the proposed system. Instead of the two-letter system, it symbolized emissions according to the following:

> Letter: Characteristics of the main carrier and type of modulation of this carrier
>
> Number: Type of final modulating signal

Letter: Characteristics of the basic signal conveying the information

F. 1979 WARC

Although Recommendation 432 underwent considerable refinement, it was the basis of the emission designator system adopted at the 1979 WARC. In that system, which follows, the first three symbols are in general use, but the fourth and fifth symbols are optionally used when greater detail is needed.

Emissions are classified by the following basic characteristics:

(1) First symbol -- type of modulation of the main carrier

(1.1) Emission of an unmodulated carrier N

(1.2) Emission in which the main carrier is amplitude modulated (including cases where subcarriers are angle modulated)

(1.2.1) Double sideband A
(1.2.2) Single sideband, full carrier H
(1.2.3) Single sideband, reduced or variable-level carrier. R
(1.2.4) Single sideband, suppressed carrier J
(1.2.5) Independent sidebands B
(1.2.6) Vestigial sideband C

(1.3) Emission in which the main carrier is angle modulated

(1.3.1) Frequency modulation F
(1.3.2) Phase modulation G

(1.4) Emission in which the main carrier is amplitude and angle modulated either simultaneously or in a pre-established sequence. D

(1.5) Emission of pulses
(Emissions where the main carrier is directly modulated by a signal which has been coded into quantized form [e.g., pulse code modulation), shall be designated as either an emission in which the main carrier is amplitude-modulated, or an emission in which the main carrier is angle-modulated)

(1.5.1) Sequence of unmodulated pulses P
(1.5.2) A sequence of pulses
(1.5.2.1) modulated in amplitude K
(1.5.2.2) modulated in width/duration L
(1.5.2.3) modulated in position/phase M
(1.5.2.4) in which the carrier is angle modulated during the period of the pulse Q

(1.5.2.5) which is the combination of the foregoing or is produced by other means — V

(1.6) Cases not covered above, in which an emission consists of the main carrier modulated, either simultaneously or in a pre-established sequence, in a combination of two or more of the following modes: amplitude, angle, pulse — W

(1.7) Cases not otherwise covered — X

(2) Second symbol -- nature of signal(s) modulating the main carrier

(2.1) No modulating signal (The word channel(s) in 2.2 through 2.7, below, in this context refers to the radio frequency [RF] channel) — 0

(2.2) A single channel containing quantized or digital information without the use of a modulating subcarrier (This excludes time-division multiplex) — 1

(2.3) A single channel containing quantized or digital information with the use of a modulating subcarrier (This excludes time-division multiplex) — 2

(2.4) A single channel containing analog information — 3

(2.5) Two or more channels containing quantized or digital information — 7

(2.6) Two or more channels containing analog information — 8

(2.7) Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analog information — 9

(2.8) Cases not otherwise covered — X

(3) Third symbol -- type of information to be transmitted (In this context the word "information" does not include information of a constant, unvarying nature such as provided by standard frequency emissions, continuous wave and pulse radards, etc.)

(3.1) No information transmitted — N

(3.2) Telegraphy -- for aural reception — A

(3.3) Telegraphy -- for automatic reception — B

(3.4) Facsimile — C

(3.5) Data transmission, telemetry, telecommand — D

(3.6) Telephony (including sound broadcasting) E

(3.7) Television (video) F

(3.8) Combination of the above W

(3.9) Cases not otherwise covered X

(4) Fourth symbol -- detail of signal(s)

(4.1) Two-condition code with elements of differing numbers and/or durations A

(4.2) Two-condition code with elements of the same number and duration without error correction B

(4.3) Two-condition code with elements of the same number and duration with error correction C

(4.4) Four-condition code in which each condition represents a signal element (of one or more bits) D

(4.5) Multi-condition code in which each condition represents a signal element (or one or more bits) E

(4.6) Multi-condition code in which each condition or combination of conditions represents a character F

(4.7) Sound of broadcasting quality (monophonic) G

(4.8) Sound of broadcasting quality (stereophonic or quadraphonic) H

(4.9) Sound of commercial quality (excluding categories K and L below) J

(4.10) Sound of commercial quality with the use of frequency inversion or band-splitting K

(4.11) Sound of commercial quality with separate frequency-modulated signals to control the level of demodulated signal L

(4.12) Monochrome M

(4.13) Color N

(4.14) Combination of the above W

(4.15) Cases not otherwise covered X

(5) Fifth symbol -- nature of multiplexing

(5.1) None N

(5.2) Code-division multiplexing (This includes bandwidth expansion techniques.) C

(5.3) Frequency-division multiplexing F

(5.4) Time-division multiplexing T

(5.5) Combination of frequency-division multiplex and time-division multiplex W

(5.6) Other types of multiplexing X

III. Designation of Emissions in the Amateur Service

A. 1933 Regulations

Federal Radio Commission regulations for the amateur service specified emissions as follows:

> 375. All bands of frequencies so assigned may be used for radiotelegraphy, type A-1 emission and also for type A-2 emission to the extent hereinafter provided.
>
> 376. The following bands of frequencies are allocated for use by amateur stations using radiotelephony, type A-3 emission:
>
> 1,875 to 2,000 kilocycles
> 56,000 to 60,000 kilocycles
>
> 377. Provided the station shall be operated by a person who holds an operator's license of a grade approved ... for unlimited amateur radiotelephone operation, amateur radio stations may use radiotelephony, type A-3 emission, in the following additional bands of frequencies:
>
> 3,900 to 4,000 kilocycles
> 14,150 to 14,250 kilocycles
>
> 378. The following bands of frequencies are allocated for use by amateur stations for television, facsimile, and picture transmission:
>
> 1,715 to 2,000 kilocycles
> 56,000 to 60,000 kilocycles

B. 1948 Regulations

The 1947 International Radio Conference expanded the emission designation system. The 1948 edition of The Radio Amateur's Handbook showed the following permissible emissions:

```
 3.500- 4.000 -- A1
 3.850- 4.000 -- A3, Class A only
 3.850- 3.900 -- NBFM, Class A only
 7.000- 7.300 -- A1
14.000-14.400 -- A1
14.200-14.300 -- A3, Class A only
14.200-14.250 -- NBFM, Class A only
27.160-27.430 -- A0, A1, A2, A3, A4, FM
28.000-29.700 -- A1
28.500-29.700 -- A3
28.500-29.000 -- NBFM
29.000-29.700 -- FM
  50.0-54.0   -- A1, A2, A3, A4
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51.0-52.5	-- NBFM
52.5-54.0	-- FM
144-148	-- A0, A1, A2, A3, A4, FM
235-240	-- A0, A1, A2, A3, A4, FM
420-450	-- A0, A1, A2, A3, A4, A5, FM
1,215-1,295	-- A0, A1, A2, A3, A4, A5, FM, Pulse
2,300-2,450	-- A0, A1, A2, A3, A4, A5, FM, Pulse
3,300-3,500	-- A0, A1, A2, A3, A4, A5, FM, Pulse
5,650-5,925	-- A0, A1, A2, A3, A4, A5, FM, Pulse
10,000-10,500	-- A0, A1, A2, A3, A4, A5, FM, Pulse
21,000-22,000	-- A0, A1, A2, A3, A4, A5, FM, Pulse
Above 30,000	-- A0, A1, A2, A3, A4, A5, FM, Pulse

C. 1984 Regulations

By 1984, just prior to implementation of the 1979 WARC emission designators which became effective January 1, 1985, section 97.61 of the Commission's rules specified emissions as follows:

Frequency band (kHz)	Emissions
1800-2000	A1,A3
3500-4000	A1
3500-3775	F1
3775-4000	A3,A4,A5,F3,F4,F5
4383.8	A3A,A3J
7000-7300	A1
7000-7150	F1
7075-7100	A3,F3 (only stations outide Region 2)
7150-7300	A3,A4,A5,F3,F4,F5
14000-14350	A1
14000-14150	F1
14150-14350	A3,A4,A5,F3,F4,F5
21000-21450	A1
21000-21250	F1
21250-21450	A3,A4,A5,F3,F4,F5
28000-29700	A1
28000-28500	F1
28500-29700	A3,A4,A5,F3,F4,F5
50.0-54.0	A1
50.1-54.0	A2,A3,A4,A5,F1,F2,F3,F4,F5
51.0-54.0	F0,F0
144.0-148.0	A1
144.1-148.0	A0,A2,A3,A4,A5,F1,F2,F3,F4,F5
220-225	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5
420-450	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5
1215-1300	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5
2300-2450	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
(GHz)	
3.300-3.500	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
5.650-5.925	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
10.000-10.500	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5

24.000-24.250	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
48.000-50.000	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
71.000-76.000	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
165-170	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
240-250	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P
Above 300	A0,A1,A2,A3,A4,A5,F1,F2,F3,F4,F5,P

Emission limitations were specified in section 97.65 of the Commission's rules, as follows:

(a) Type A0 emission, where not specifically designated in the bands listed in section 97.61, may be used for short periods of time when required for authorized remote control purposes or for experimental purposes. However, these limitations do not apply where type A0 emission is specifically designated.

(b) Whenever code practice, in accordance with section 97.91(d), is conducted in bands authorized for A3 emission tone modulation of the radiotelephone transmitter may be utilized when interspersed with appropriate voice instructions.

(c) On frequencies below 29.0 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics.

(d) On frequencies below 50 MHz, the bandwidth of A4, A5, F4 and F5 emissions shall not exceed that of an A3 single-sideband transmission.

(e) On frequencies between 50 MHz and 225 MHz:

(1) The bandwidth of A4 and A5 single-sideband emissions shall not exceed the bandwidth of an A3 single-sideband emission.

(2) The bandwidth of A4 and A5 double-sideband emissions shall not exceed the bandwidth of an A3 double-sideband emission.

(3) F4 and F5 emissions shall utilize a peak carrier deviation no greater than 5 kHz and a maximum modulating frequency no greater than 3 kHz or, alternatively, shall occupy a bandwidth no greater than 20 kHz. (For this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power of any emission is attenuated by at least 26 decibels below the mean power level of the total emission. A 3 kHz sampling bandwidth is used by the FCC in making this determination.)

(f) Below 225 MHz, an A3 emission may be used simultaneously with an A4 or A5 emission on the same carrier frequency, provided that the total bandwidth does not exceed that of an A3 double-sideband emission.

Note that the Commission uses emission designators, such as A3, to signify both double-sideband and single-sideband emissions, as the emission designators are so qualified, above.

In addition, section 97.69 specified further limitations on digital communications emissions, as follows:

(a) The use of digital codes specified in paragraph (b) of this section is permitted on any amateur frequency where F1 emission is permitted, subject to the following requirements:

(1) The sending speed shall not exceed the following:

(i) 300 baud on frequencies below 28 MHz;

(ii) 1200 baud on frequencies between 28 and 50 MHz;

(iii) 19.6 kilobaud on frequencies between 50 and 220 MHz;

(iv) 56 kilobaud on frequencies above 220 MHz.

(2) When type A2, F1 or F2 emissions are used on frequencies below 50 MHz, the radio or audio frequency shift (the difference between the frequency for the "mark" signal and that for the "space" signal), as appropriate, shall not exceed 1000 Hz. When these emissions are used on frequencies above 50 MHz, the frequency shift, in hertz, shall not exceed the sending speed, in baud, of the transmission, or 1000 Hz, whichever is greater.

* * *

(c) In addition to the above provision, the use of any digital code is permitted on amateur frequencies above 50 MHz, except those on which only A1 emission is permitted, subject to the following requirements:

* * *

(2) The bandwidth of an emission from a station using such digital codes [ITA2, ASCII or AMTOR] shall not exceed the following (where for this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power of any emission

is attenuated by at least 26 decibels below the mean power of the total emission; a 3 kHz sampling bandwidth being used by the FCC in making this determination):

(i) 20 kHz on frequencies between 50 and 220 MHz;

(ii) 100 kHz on frequencies between 220 and 1215 MHz;

(iii) On frequencies above 1215 MHz any bandwidth may be used provided that the emission is in accordance with section 97.63(b) and section 97.73(c).

D. 1985 Regulations

The following emissions became effective in 1985 upon implementation of the 1979 WARC under General Docket No. 80-739:

Section 97.61 Authorized emissions.

(a) kilohertz:

Frequency Band	Emissions
1800-2000	A1A,F1B,A3E,F3E,G3E,A3C,F3C,A3F, F3F,H3E,J3E,R3E
3500-3750	A1A,F1B
3750-4000	A1A,A3E,F3E,G3E,A3C,A3F,F3C,F3F, H3E,J3E,R3E
5167.5	J3E,R3E
7000-7075	A1A,F1B
7075-7100	A1A,F1B (Amateur stations located in Regions 1 and 3, and amateur radio stations which are west of 130 degrees West longitude or south of 20 degrees North latitude may also use A3E,F3E,G3E, H3E,J3E and R3E emissions)
7100-7150	A1A,F1B
7150-7300	A1A,A3E,F3E,G3E,A3C,F3C,A3F,F3F, H3E,J3E,R3E
10100-10150	A1A,F1B
14000-14150	A1A,F1B
14150-14350	A1A,A3E,F3E,A3C,F3C,A3F,F3F,H3E, J3E,R3E
21000-21200	A1A,F1B
21200-21450	A1A,A3E,F3E,A3C,F3C,A3F,F3F,H3E, J3E,R3E
24890-24930	A1A,F1B
24930-24990	A1A,A3E,F3E,G3E,A3C,F3C,A3F,F3F, H3E,J3E,R3E
28000-28300	A1A,F1B
29500-29700	A1A,A3E,F3E,G3E,A3C,F3C,A3F,F3F, H3E,J3E,R3E

(b) 50-144.1 MHz:

50.0-50.1	A1A
50.1-51.0	A1A,A2A,A2B,A3E,A3C,A3F,F1B,F2B, F3E,G3E,F3C,F3F,H3E,J3E,R3E
51.0-54.0	N0N,A1A,A2A,A2B,A3E,A3C,A3F,F1B, F2B,F3E,G3E,F3C,F3F,H3E,J3E,R3E
144.0-144.1	A1A

(C) Above 144.1-MHz: Amateur stations are authorized to transmit the following emissions on amateur frequencies above 144.1 MHz: N0N,A1A,A2A,A2B,A3E,A3C, A3F,F1B,F2B,F3E,G3E,F3C,F3F,H3E,J3E and R3E. P0N emissions (the emission letters "K,L,M,Q,V,W and X" may also be used in place of the letter "P" for pulsed radars) may be transmitted at all amateur frequencies above 2300 MHz, except in the 10.0-10.5 GHz band. In the 902-928 MHz band F8E emissions may also be used.

Section 97.65 Emission limitations.

(a) Type N0N emission, where not specifically designated in the bands listed on section 97.61, may be used for short periods of time when required for authorized remote control purposes or for experimental purposes. However, these limitations do not apply where type N0N emission is specifically designated.

(b) Whenever code practice, in accordance with section 97.91(d), is conducted in bands authorized for A3E emission tone modulation of the ratiotelephone transmitter may be utilized when interspersed with appropriate voice instructions.

(c) On frequencies below 29.0 MHz, the bandwidth of an F3E or G3E emission (frequency or phase modulation) shall not exceed that of an A3E emission having the same audio characteristics.

(d) On frequencies below 50 MHz, the bandwidth of A3C,A3F,F3C and F3F emissions shall not exceed that of a J3E single-sideband emission.

(e) On frequencies between 50 MHz and 225 MHz:

(1) The bandwidth of A3C and A3F single-sideband emissions emissions shall not exceed the bandwidth of a J3E single-sideband emission.

(2) The bandwidth of A3C and A3F double-sideband emissions shall not exceed the bandwidth of an A3E double-sideband emission.

(3) F3C and F3F emissions shall utilize a peak carrier deviation no greater than 5 kHz and a maximum modulating frequency no greater than 3 kHz or, alternatively, shall occupy a bandwidth no greater than 20 kHz. (For this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power level of any emission is attenuated by at least 26 decibels below the mean power level of the total emission. A 3 kHz sampling bandwidth is used by the FCC in making this determination.)

(f) Below 225 MHz, an A3C or A3F emission may be used simultaneously with an A3E emission on the same carrier frequency, provided that the total bandwidth does not exceed that of an A3E double-sideband emission.

In addition, section 97.69 specified further limitations on digital communications emissions, as follows:

(a) The use of digital codes specified in paragraph (b) of this section is permitted on any amateur frequency where F1B emission is permitted, subject to the following requirements:

(1) The sending speed shall not exceed the following:

(i) 300 baud on frequencies below 28 MHz;

(ii) 1200 baud on frequencies between 28 and 50 MHz;

(iii) 19.6 kilobaud on frequencies between 50 and 220 MHz;

(iv) 56 kilobaud on frequencies above 220 MHz.

(2) When type A2B, F1B or F2B emissions are used on frequencies below 50 MHz, the radio or audio frequency shift (the difference between the frequency for the "mark" signal and that for the "space" signal), as appropriate, shall not exceed 1000 Hz. When these emissions are used on frequencies above 50 MHz, the frequency shift, in hertz, shall not exceed the sending speed, in baud, of the transmission, or 1000 Hz, whichever is greater.

* * *

(c) In addition to the above provision, the use of any digital code is permitted on amateur frequencies above 50 MHz, except those on which only A1 emission is permitted, subject to the following requirements:

* * *

(2) The bandwidth of an emission from a station using such digital codes [ITA2, ASCII or AMTOR] shall not exceed the following (where for this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power of any emission is attenuated by at least 26 decibels below the mean power of the total emission; a 3 kHz sampling bandwidth being used by the FCC in making this determination):

(i) 20 kHz on frequencies between 50 and 220 MHz;

(ii) 100 kHz on frequencies between 220 and 902 MHz;

(iii) On frequencies above 902 MHz any bandwidth may be used provided that the emission is in accordance with section 97.63(b) and section 97.73(c).

Beacon operation had these special provisions specified in section 97.87:

The following amateur frequency bands and emissions are available for automatically controlled beacon operation: 28.20-28.30 MHz, 50.06-50.08 MHz, 144.05-144.06 MHz, 220.05-220.06 MHz, 222.0-222.06 MHz, and 432.07-432.08 MHz using type N0N,A1A,F1B or J2A emissions (when type F1B or J2A emissions are employed in these bands, the radio or audio frequency shift, as appropriate, shall not exceed 1000 Hz)....

E. 1986 Additions

In an Order released February 28, 1986, the Commission amended Part 97 of its rules to authorize the use of F2A emission above 29.5 MHz, except in the subbands where only A1A emission is permitted.

Effective June 1, 1986, section 97.71 permitted spread-spectrum transmissions to:

...convey information containing voice, teleprinter, facsimile, television, signals for remote control of objects, computer programs, data, and other communications including communication protocol elements... on amateur frequencies above 420 MHz.

F. 1987 Additions

Effective April 6, the FCC authorized emission F8E on all amateur frequencies 902 MHz and above.

IV. What Was Affected in Part 97 by the Translation

On October 26, 1984, the Commission adopted the Third Report and Order for General Docket No. 80-739, which implemented the 1979 WARC emission designators in Part 2, Part 97 and other Parts of the Commission's rules. That R&O was reviewed by the ARRL and found to contain numerous omissions and discrepancies. In December, 1984, a list of these problems was provided to the Commission's staff, and the ARRL received informal assurances that errata would be issued. The list attempted only to correct the technical problems in translating from the old system to the new. Feedback from the Commission's staff was that, while technically correct, our draft simply made matters worse in terms of the average reader understanding it. We accepted this feedback and began work on a simplified approach. By then, however, the deadline to file a Petition for Partial Reconsideration, and the Commission did not elect to issue errata on their own initiative.

The basic problem with the translation was that it attempted to make one-for-one substitutions in the emission symbols. This caused general (even loose) designations to be replaced by more-restrictive ones. Some of the old designators should have been translated to several new ones. In other cases, technical errors crept into the translation, probably because of the massive paperwork involved with General Docket No. 80-739.

Anomalies found in reviewing the translation process are outlined below.

A. A1A Was Substituted for A1

A1 had been in Part 97 rules, A1A was substituted. This appeared to be a straightforward translation but can be shown to be otherwise. Compare definitions:

A1	Type of modulation of main carrier:	Amplitude Modulation
	Type of transmission :	Telegraphy without the use of a modulating audio frequency (by on-off keying)
	Supplementary characteristics :	--
A1A	Type of modulation of main carrier:	Emission in which the main carrier is amplitude modulated (including cases where subcarriers are angle modulated), double sideband

Signal(s) modulating main carrier : A single channel containing quantized or digital information without the use of a modulating subcarrier.

Note: Emissions where the main carrier is directly modulated by a signal that has been coded into quantized form (for example, pulse code modulation) should be designated under (1.2) or (1.3). (1.2 refers to first symbols A, H, R, J, B and C; 1.3 refers to first symbols F and G.)

Type of information transmitted : Telegraphy -- for aural reception

The old A1 designation had no restriction as to the method of reception: aural or automatic. A1A specifies "for aural reception." Does that mean that the receiving station must receive the signal aurally and may not use a computer to decode and display the signal? A reasonable interpretation would be that "for aural reception" means that the signal is one that could be read by ear and that probably narrows it down to Morse code. Note that A1 did not restrict the emission to ear-readable signals or Morse code, but A1A essentially does that. In keeping with "aural reception," one might also conclude that the speed of transmission must be within those that can be read by human operators. Does that mean a maximum speed of 20 WPM, which can be read by many Morse operators, or a speed limit of (say) 60 WPM, which can be read by a few. Would A1A permit an amateur to transmit Morse code at 300 WPM to be received by a computer? One viewpoint might be that it was authorized before when the rules specified A1, therefore it is permissible now. However, that is not what a literal reading of the definition of A1A would say. A relevant question is: Would anyone want to transmit 300-WPM Morse? The answer is "yes." It is a mode used mainly in Europe for meteor-scatter communications. There appears to be no reason why it should be prohibited in the United States.

It appears that 300-WPM on/off-keyed (OOK) Morse should be permitted because it was under the old system, had no record as presenting harmful interference to other users, and it is a mode with which amateurs should be free to experiment. Is it then reasonable to permit such operation everywhere in the amateur bands where A1 was permitted (all frequencies except for the Alaskan emergency frequency)? Probably not. Undoubtedly, the original intent of allowing A1 to be used anywhere in the amateur bands was done so with OOK, aurally receivable Morse code in mind. That is, amateurs should be free to call any station using OOK Morse, even on what is considered the "phone" bands. This means that the restrictive sense of A1A applies essentially to the "phone" bands, and a more liberal interpretation (i.e., the looser A1 definition) would apply elsewhere.

When the old emission designators were first devised, there was only one way of producing an OOK signal in general use; i.e., the main carrier was keyed on and off. That fit the definition of A1. With the advent of single-sideband transmitters during the 1950s, it became possible for OOK signals to be generated by another means: An OOK subcarrier was used to modulate the single-sideband transmitter. Prior to publication of the ITU Radio Regulations, Geneva, 1959, there was no official symbol for the alternative method, but afterwards A2J could have been used. Part 97 of the rules did not specify A2J wherever A1 was shown, but showed it only paragraph 97.61(e), emissions available for automatically controled beacons. In this case, however, A2J was used in another interpretation: "when type F1 or A2J emissions are employed ... the radio or audio frequency shift, as appropriate, shall not exceed 1000 Hz." Here the rules referred to frequency shifting, not one/off keying of the subcarrier. A2J was ambiguous in this respect, as is the new designator J2A.

One might ask: Why bring this up? Monitoring stations cannot tell the difference between an A1A signal and an OOK J2A signal. The point is that A1A is quite specific and does not include the alternative means of generation -- J2A. Also, J2A is in common use in the amateur service. Showing A1A but not J2A was raised by Rockwell International Corporation, and the Commission corrected this oversight in Parts 81, 83 and 90 of its rules but not in Part 97. The justification that many transmitters use the J2A method also applies in the amateur service.

When A1 was originally conceived, the technology was such that this meant simply the on/off keying of a carrier, which produces double sidebands, just as A3 meant double-sideband amplitude-modulated voice. In the 1950s, when single-sideband (SSB) radiotelephony was introduced, it became necessary to qualify A3 with "single-sideband" to convey an SSB emission. The qualifier "J" was then added to signify SSB when needed. There was the general understanding that whenever A3 was specified that A3J, being a subset thereof, was also permitted. In fact, the first symbol "A" did not specify the number of sidebands or the level of the carrier as it does today. "A" literally means full carrier, double sideband; "A" does not encompass the subsets because they have separate designators: "B," "C," "H," "J," and "R."

Thus, if an amateur wanted to experiment with eliminating a sideband of an OOK transmission, possibly for reasons of spectrum conservation, A1A would not permit it unless the Commission's rules were to have a general statement permitting "B," "C," "H," "J" and "R" to be substituted wherever "A" appears. Such a statement expanding the meaning of "P" (meaning pulse) now appears in the rules. Elimination of sidebands or suppressing the carrier of a low-speed Morse OOK transmission was not feasible at the time that A1 was conceived, but it is now, particularly with digital-signal-processing (DSP) techniques which permit the design of sharp filters without ringing. SSB Morse may not be a priority need at the moment in that it would add complexity

and save only half of the relatively small bandwidth of about 150 Hz. However, elimination of a sideband and suppression of a carrier becomes an important spectrum-conservation issue when high-speed keying is involved. An example of this type of modulation is CCITT V.35 (Modems for Synchronous Data Transmission using 60-108 kHz Group Band Circuits) where a pilot frequency of 104.08 kHz and lower sideband is used (upper sideband is suppressed) for data transmissions at 48, 56, 64, or 72 kbit/s. The old designator A1 would have permitted this type of transmission, the new A1A does not, and there were no corresponding emission designators added to Part 97 to permit it. Such an omission has not been important to date, but in the near future amateurs will need to experiment with various forms of spectrum-conservative modulation methods for high-speed data (packet radio). SSB OOK is one of several viable candidates.

B. F1B Was Substituted for F1

F1 had been in Part 97 rules, F1B was substituted. This narrowed the permissible types of communications. Compare definitions:

F1	Type of modulation of main carrier:	Frequency Modulation
	Type of transmission :	Telegraphy by frequency shift keying without the use of a modulating audio frequency: one of two frequencies being emitted at any instant
	Supplementary characteristics :	--
F1B	Type of modulation of main carrier:	Emission in which the main carrier is angle (F = frequency modulation)
	Signal(s) modulating main carrier :	A single channel containing quantized or digital information without the use of a modulating subcarrier.

Note: Emissions where the main carrier is directly modulated by a signal that has been coded into quantized form (for example, pulse code modulation) should be designated under (1.2) or (1.3). (1.2 refers to first symbols A, H, R, J, B and C; 1.3 refers to first symbols F and G.)

	Type of information transmitted :	Telegraphy -- for automatic reception

The old F1 designation was simply telegraphy by frequency shifting the main carrier. The 1959 ITU definition of telegraphy was:

> A system of telecommunication which is concerned in any process providing transmission and reproduction at a distance of documentary matter, such as written or printed matter or fixed images, or the reproduction at a distance of any kind of information in such a form. The foregoing definition appears in the Convention, but, for the purposes of these Regulations, telegraphy shall mean, unless otherwise specified, "A system of telecommunication for the transmission of written matter by the use of a signal code.

(The current Radio Regulations continue the above definitions except that the word "form" replaces "system.")

In other words, "telegraphy" includes Morse, teletypewriter and facsimile. The inclusion of facsimile is borne out by its 1959 ITU definition, which follows:

> A system of telegraphy for the transmission of fixed images, with or without half-tones, with a view to their reproduction in a permanent form.

(Again, the current Radio Regulations continue the above definitions except that the word "form" replaces "system.")

While facsimile was implied wherever F1 appeared (by tracing definitions through the Radio Regulations), that may be a tortuous path since the ITU chose to also use F4 in 1959 Radio Regulations where it meant to signify frequency-modulated facsimile.

Wherever F1 appeared in the rules, the first assumption was made that it referred to radioteletype (RTTY). That was a safe assumption until the advent of packet radio in 1980. Because there was no other emission designator that seemed to fit packet radio, F1 appeared to cover it. It appeared to fall under the general category of "telegraphy," although the ITU definition did not completely embrace computer-to-computer (or data) communications. However, when F1 was replaced, F1B seemed to fit only RTTY, known in CCIR parlance as narrow-band direct-printing. In other words, F1B implies something that is formated for page printing, i.e., a teletypewriter. It becomes clear that "B" was not intended to cover packet radio because there is a separate letter "D" which is defined as "data transmission, telemetry, telecommand."

From this, since there is no emission designator ending in "D" in Part 97 of Commission's rules, one might conclude that packet radio, data transmission, telemetry and telecommand are not permitted in the amateur service. However, section 97.69 clearly states that such transmissions are permitted, thus:

> Subject to the special conditions contained in paragraphs (a), (b) and (c) below, an amateur radio communication may include digital codes which represent alphanumeric characters, analogue measurements or other information. These digital codes may be used for such communications as (but not limited to) radio teleprinter, voice, facsimile, television, communications to control amateur radio stations, models or other objects, transference of computer programs or direct computer-to-computer communications, and communications in various types of data networks (including so-called "packet switching" systems)...

It is reasonable to conclude that data transmission is permitted but that appropriate emission designators are missing from Part 97 of the Commission's rules. It is also apparent that F1B was thought to cover it but technically does not.

As in the case of an alternative method of generating an OOK signal, there is one for producing what appears on the air to be an F1B or F1D signal. In this case, an audio tone is frequency shifted then used to modulate a single-sideband transmitter. Audio-frequency-shift keying (AFSK) is the predominant modulation method now in use for both RTTY and packet radio in the amateur service. Technically, the AFSK modulation alternative becomes J2B for RTTY and J2D for packet radio, but neither of these emission designations appear in Part 97 of the Commission's rules.

The old designator F1 did not specify which form of telegraphy. It certainly included F1 Morse telegraphy as well as radioteletype. The new symbol F1B specifies "for automatic reception," apparently overlooking aurally received (Morse) telegraphy. The correct symbol for F1 for aural reception would be F1A, and for the alternative generation technique would be J2A. Neither are in Part 97 of the Commission's rules.

C. <u>F Was Substituted for F</u>

The first symbol "F" in the old emission designator system was defined as "frequency (or phase) modulation." In the new system, "F" means only frequency modulation, not phase modulation which is assigned the designation "G." A complete translation from the old system would have required that wherever there is an emission symbol beginning with "F" there would be a corresponding one beginning with "G." However, this is not the case. For example, F1B appears frequently in section 97.61 of the Commission's current rules, but G1B does not. Frequency modulation and phase modulation are generally similar and sometimes identical, and both fall under the general category of angle modulation which has no individual symbol.

D. A3C and F3C Were Substituted for A4 and F4

Again, this appeared to be a fairly direct translation but can be shown to be otherwise. Compare definitions:

A4	Type of modulation of main carrier:	Amplitude Modulation
	Type of transmission :	Facsimile (with modulation of main carrier either directly or by a frequency-modulated sub-carrier)
	Supplementary characteristics :	--
A4A	Type of modulation of main carrier:	Amplitude Modulation
	Type of transmission :	Facsimile (with modulation of main carrier either directly or by a frequency-modulated sub-carrier)
	Supplementary characteristics :	Single sideband, reduced carrier
A3C	Type of modulation of main carrier:	Emission in which the main carrier is amplitude modulated (including cases where subcarriers are angle modulated), double sideband
	Signal(s) modulating main carrier :	A single channel containing analog information
	Type of information transmitted :	Facsimile

The old emission symbol A4 did not specify that the facsimile signal was analog, but the new symbol A3C does. Facsimile as transmitted in the amateur service was often digital in the sense that only black-and-white images were normally transmitted and a continuous gray scale (analog) was not present. For digital signals of this nature, it would have been more technically accurate to use the symbol A2C where a modulating subcarrier is used (the usual case) and A1C where no modulating subcarrier is used. A1C and A2C would cover cases where there is either simply black-and-white or stepped gray scale (quantized). A3C is appropriate only when a continuous gray scale (analog signal) is transmitted.

At high frequencies in the amateur service, facsimile would normally be transmitted by varying a tone which modulates a single-sideband transmitter. Single-sideband symbols are "H," "J" and "R," none of which appear in Part 97 of the Commission's rules for facsimile. The predominant mode at HF in the amateur service for facsimile is J2C, which is not included in Part 97.

Also, compare definitions for the old F4 and new F3C:

F4	Type of modulation of main carrier:	Frequency Modulation
	Type of transmission :	Facsimile (with modulation of main carrier either directly or by a frequency-modulated sub-carrier)
	Supplementary characteristics :	--
F3C	Type of modulation of main carrier:	Emission in which the main carrier is frequency modulated
	Signal(s) modulating main carrier :	A single channel containing analog information
	Type of information transmitted :	Facsimile

As above, The old emission symbol F4 did not specify that the facsimile signal was analog, but the new symbol A3C does. Facsimile as transmitted in the amateur service was often digital in the sense that only black-and-white images were normally transmitted and a continuous gray scale (analog) was not present. For digital signals of this nature, it would have been more technically accurate to use the symbol F2C where a modulating subcarrier is used (the usual case) and F1C where no modulating subcarrier is used. F1C and F2C would cover cases where there is either simply black-and-white or stepped gray scale (quantized). F3C is appropriate only when a continuous gray scale (analog signal) is transmitted.

E. A3F and F3F Were Substituted for A5 and F5

What is detailed in paragraph D, above, for facsimile also applies to slow-scan television (SSTV), except that both continuous tone and quantized modulation are in frequent use. Continuous tone is usually the product of a television camera, while a quantized output is normally from a computer.

The emission symbols for fast-scan television, however, presented a special problem in that both double-sideband (A3F) and vestigial-sideband (C3F) are in use in the amateur service. A3F appears in Part 97 of the Commission's rules, but the more spectrally conservative C3F does not.

F. Simultaneous Voice and Image Transmission

Prior to implementing the new emission designators, paragraph 97.65(f) read:

> Below 225 MHz, an A3 emission may be used simultaneously with an A4 or A5 emission on the same carrier frequency, provided that the total bandwidth does not exceed that of an A3 double-sideband emission.

Although not so qualified, it is clear that the first reference to A3, above, meant the single-sideband subset of A3 or A3J. Similarly, A4 and A5 were also implied A4J and A5J.

The current paragraph 97.65(f) reads as follows:

> Below 225 MHz, an A3C or A3F emission may be used simultaneously with an A3E emission on the same carrier frequency, provided that the total bandwidth does not exceed that of an A3E double-sideband emission.

This has a technical inconsistency in that A3C, A3F and A3E all specify double-sideband amplitude modulation. Transmitting A3C or A3F and A3E on the same carrier frequency would result in a garble of both the voice and image transmissions. The first symbol in these cases should have been "J" to signify single sideband.

There is a similar technical error (using A instead of J) in the current paragraphs 97.65(d) and (e).

G. Pulse Modulation Translation

In the Part 97 of the Commission's rules prior to the implementation of the new emission designators, pulse emission was authorized by the appearance of the single letter "P" in paragraph 97.61(a).

In the current rules, paragraph 97.61(c) specifies the emission symbol PØN and goes on to say that "the emission letters 'K, L, M, Q, V, W and X' may also be used in place of the letter 'P' for pulsed radars)..." There are problems with the second and third symbols (ØN) as they are defined as:

Signal(s) modulating main carrier	:	No modulating signal
Type of information transmitted	:	No information transmitted

Thus, the current emission designators for pulse modulation permit only repetitious pulses (such as for radar) but do not permit the transmission of information. The primary use of pulse in the amateur service would be for communications with radar-type applications being minimal.

H. Simultaneous Amplitude and Angle Modulation

First symbol "D," "Emission in which the main carrier is amplitude and angle modulated either simultaneously or in a pre-established sequence" is included in the new ITU emission designators but not carried forward to Part 97 of the Commission's rules. Under the old (looser) system, there was a general understanding that if both frequency (including phase) and amplitude modulation were authorized, the combination of the two would be as well. However, the new system is so specific as to have a separate designator, "D," which removes the ambiguity and requires that it be explicitly authorized.

There is a definite need for combined amplitude and angle modulation in the amateur service for spectrum-conservation reasons. For example, a constellation modulation system (combination of amplitude and phase) will be needed for high-speed packet networks (for speeds in excess of 56 kbit/s) in the 1990s.

I. Multiplexing

As late as the 1970s, there was minimal need for multiplexing in the amateur service. Since the 1979 WARC, interest in multiplexing, while not yet large, is growing because of the economic and spectrum savings possible by adding more information channels on existing transmitters. In the next one or two decades, incentives for much more multiplexing will intensify. It is expected that digital multiplexing will be common in the amateur service microwave bands.

The Commission was petitioned to add the emission designator F8E (frequency modulation of the main carrier, two or more channels containing analog information, telephony) to the emissions authorized in Part 97 for the 902-928 MHz band. F8E was added under PR Docket No. 84-960. Subsequently, the Commission was petitioned to permit F8E emission in all amateur bands above 928 MHz, which was also granted by the Commission under PR Docket No. 86-207. Note that F8E permits amateurs to multiplex only two or more analog channels, not digital not composite analog and digital, which have other emission designators. Note that F8E does not permit phase modulation. One would assume that the Commission would respond favorably to the addition of these other variations if petitioned. However, repeating the paperwork in the manner of PR Docket Nos. 84-960 and 86-207 seems an unnecessary burden on both the petitioners and the Commission.

V. Basic Objectives of Specifying Amateur Service Emissions

As a foundation for consideration of a new system of specifying emissions in the amateur service, the following basic objectives are offered:

- All emissions must be confined within amateur bands.
- The system must be unambiguous yet easy to understand, even for the prospective Novice.
- It should permit grouping of compatible modulation and information modes by frequency. Obversely, it should separate incompatible modes.
- It should encourage experimentation with new modulation techniques.
- The use of new modulation techniques should not impose a paperwork burden, or delay involved therein, on petitioners or the Commission.
- The system should encourage improved spectrum management in the amateur service yet continue to permit older forms of modulation until no longer needed.

VI. Discussion of Some Alternatives

A. Add the Missing Emission Designators

This approach can be rejected for reasons of complexity, difficulty of comprehension for most people, and a paperwork burden. There are as many as 1296 possible emission designators. If some were omitted because no one conceived of a use initially but found one later, the rules would need to be changed once more. Informal communication with the Commission's staff has demonstrated a general distaste for adding dozens more emission designators to the rules.

B. The Docket 20777 Approach

Docket 20777 proposed sweeping changes in what types of emission would be permitted, and how they would be specified, in the amateur service. There was considerable public response, which combined to defeat the basic thrust of the Docket. The lasting product of these proceedings, however, was the authorization of the ASCII code and packet radio.

The basic thrust, referred to above, was to regulate amateur radio emissions only by bandwidth, not by emission designators. The elegance of this approach was recognized by many amateurs, particularly experimenters. Unfortunately, most amateurs did not agree with it because they wanted the Commission's rules to guarantee that only certain types of activities would be allowed in specific subbands. In the 20777 approach, the narrower-bandwidth modes would be permitted to operate in subbands where wider bandwidths were allowed, but not vice versa. A fear was that RTTY stations could operate in the "phone" bands.

The pure regulate-by-bandwidth approach is not sufficient in itself but it merits consideration in a suitable hybrid solution.

C. Specify by English Words

Since the early years of radio, amateurs have referred to different parts of the amateur bands as "CW" and "phone" bands. Words of this type are easy to understand but tend to be ambiguous unless defined.

By itself, this approach is inadequate but should be considered as part of a hybrid system.

D. Complete Deregulation of Amateur Emissions

In a deregulatory atmosphere, the laissez-faire approach has its attraction. It can be shown that band plans adopted by the IARU and ARRL have been effective to a considerable degree. Because band plans are not codified in federal regulations, evolutionary expansion of a growing mode into the past band space of an old mode is possible without involving the Commission. Nevertheless, comments from amateurs in response to Docket No.

20777 overwhelmingly showed that the majority of amateurs want a certain amount of regulation of emissions in order to separate incompatible modes.

While band plans alone cannot be relied upon to protect the interests of the majority of amateurs, they nonetheless must be an important pillar of a satisfactory system. Without band plans, the Commission would be called upon to adjudicate more disputes between users, and could expect endless petitions for rule changes and special temporary authority to permit new emissions or change subbands in which particular emissions may be used.

VII. Derivation of an Appropriate System

A. Basic Approach

From the foregoing, it can be concluded that:

- o Adding all or nearly all of the 1296 possible ITU emission designators to Part 97 is cumbersome and unjustified.

- o Specifying groups of emissions by English-word or commonly understood abbreviations, such as "phone," should be the basis of the system and is appropriate for the amateur service.

- o While bandwidth alone is inappropriate to separate incompatible modes within a frequency band, some bandwidth limitations are necessary to promote spectrum conservation, and should be part of the system.

B. What to Specify

As review, the ITU emission designators specify five different parameters of an emission (first through fifth symbol):

1. Type of modulation of the main carrier
2. Nature of signal(s) modulating the main carrier
3. Type of information to be transmitted
4. Detail of signal(s)
5. Nature of multiplexing

It will be shown, below, that there is no need to specify all of the above emission parameters, as only the "type of information to be transmitted" (third symbol) is at issue with amateur radio operators. The only other basic regulatory issue is "type of modulation of the main carrier" (first symbol) in order to prevent pulse modulation from being used on certain bands. The Commission has chosen to make the use of the fourth and fifth symbols optional, which effectively deregulates them.

The Commission's attitude toward emissions in the amateur bands has been consistently more liberal than that of amateur radio operators. In the present deregulatory atmosphere, it can be said that the Commission has little or no desire to control emissions within the amateur frequency bands except to limit interference in shared bands and to comply with international regulations. It would be reasonable to conclude that the Commission would like to see amateurs control subband edges by informal arrangements, called band plans, based on peer pressure. However, amateur radio operators have consistently commented to the Commission in favor of some partitioning of emissions. It is desirable to separate what amateurs feel is important for Part 97 to specify from that which is more appropriately handled by band plans. Originally, the amateur rules specified emissions in order to keep phone out of the CW bands. Later, after radioteletype came along, the rules also served to keep RTTY out of the phone bands. Then with the advent of facsimile and slow-scan

television, amateur experimenters found it desirable to operate voice on the same frequencies as FAX and SSTV in order to coordinate experiments. Thus FAX and SSTV are accepted as part of the "phone" subbands with certain frequencies designated by band plans. In the 1970s and 1980s, however, there was a growth of RTTY first, then packet radio. Operation of these digital modes took place, generally, at the top of what was regarded as the "CW" subbands. Band plans designate the largest portion to CW and the smallest to digital communications (meaning RTTY and packet). Over the past two decades, the amount of frequency space taken by digital communications has grown into space once occupied by CW. While there has been some contention among amateur radio operators over the expansion of digital communications into CW space, it has been demonstrated that amateurs find it acceptable to manage the CW-digital demarcation by means of band plans, not by federal regulation. It can be reasoned that this is desirable as it allows evolutionary trends to take place and permits amateurs to continue to do real-time frequency management according to operational needs. One can conclude that there is need for two basic emission groups within Part 97, which are:

- o Phone, FAX and SSTV
- o CW, RTTY and packet

C. How to Specify

1. Analog vs Digital

It can be shown that there is some correlation between "analog and digital" and the two basic emission groups mentioned above. That is, CW, RTTY and packet are digital, and at first blush phone, FAX and SSTV appear to be analog. Unfortunately, black-and-white (no gray scale) FAX and SSTV are digital; with stepped gray scales (such as computer-generated images) they are quantized. The second symbol of the ITU emission designators treats digitized and quantized information alike. Nonetheless, quantized images approach, and can be confused with, analog images. To specify "analog" for phone operation would be done at the expense of limiting amateur experimentation with digital voice, which is regarded as an important research area and leading to great improvement in communication technology. Part 97's use of the word "digital" to describe automatic modes such as RTTY and packet as distinct from CW has been artificial in that Morse CW is a digital mode. Thus, neither "analog" nor "digital" are technically valid to separate the two basic emission groups and should not be used.

2. Narrowband vs Wideband

Some individuals and groups within the amateur service have chosen the words "narrowband" and "wideband" to distinguish between the two basic emission groups. This type of definition is unsuitable for regulatory purposes. The words "narrow" and "wide" are only relative terms and require redefini-

tion (if there is to be any definition) from band to band. When these terms were first introduced, primarily by those outside the U.S. amateur community, "narrowband" was used to describe CW and RTTY, while "wideband" indicated phone, FAX and SSTV. However, RTTY and packet radio, depending on frequency shift and data rate, can occupy about the same bandwidth as FAX and SSTV, i.e., nearly a voice-frequency channel. Thus the distinction between "narrow" and "wide" is blurred. Furthermore, the emphasis is on bandwidth, not the type of information to be transmitted, which is what U.S. amateurs want the rules to partition.

3. Morse vs CW

The word "Morse" is fairly descriptive of the communications mode but does not imply the type of modulation of the main carrier, i.e., on-off keying (OOK), also called amplitude-shift keying (ASK). In order for the word "Morse" to be used, it would be necessary to add the type of modulation of the main carrier in some form in order to provide for the following variations, some of which should be limited by frequency: OOK Morse, tone-modulated Morse and frequency-shift-keyed (FSK) Morse. Such descriptors would become unwieldy in frequency tables.

The abbreviation "CW" is well accepted within amateur radio as meaning OOK Morse. The abbreviation "MCW" is also accepted as meaning on-off-keyed tone-modulated Morse.

FSK Morse has been permitted in the amateur service since the early 1950s with the advent of FSK RTTY operation by virtue of the appearance of the emission symbol F1 in Part 97. A literal reading of present Part 97 rules indicates that it is not now permitted, as the new emission designator F1A does not appear.

There is a need for FSK Morse in certain propagation beacons to provide a steady on-the-air signal for measurements, and for reception both aurally and automatically. Emissions permitted for beacon operation in section 97.87 are exceptions to the emissions authorized in section 97.61, which are: NØN, A1A, F1B and J2A. Technically, FSK Morse is permitted for automatic reception, not aural reception, according to the appearance of F1B but not F1A. However, if a tone modulating the main carrier is frequency shifted, aural reception is permissible but automatic reception is not as J2A is nonspecific with respect to tone keying (i.e., on/off vs frequency shifted).

Also, there has been no demonstrated need for the Commission to prohibit FSK Morse in bands where radioteletype is permitted in that amateurs have had no history of inappropriate use of FSK Morse. One might argue that FSK Morse is not as spectrally efficient as OOK Morse. If FSK Morse is to be received aurally, that is true because one of the two tones is ignored by the receiving operator. FSK Morse has considerable signal-to-noise advantages for automatic reception and was used extensively in the early days of radio for recording on undulator tape (slip) on commercial, not amateur, circuits.

There are only a few frequency subbands where OOK Morse is permitted but where one might argue that FSK Morse should be prohibited. They are:

- The Novice CW bands:

  3700-3750 kHz
  7050-7075 kHz (Regions 1 and 3)
  7100-7150 kHz (Region 2)
  21100-21120 kHz
  28100-28300 kHz

Perhaps it would be desirable to prohibit Novices and Technicians from using FSK Morse in the above CW bands simply to get them used to using OOK Morse. However, in that there has been no inappropriate use of FSK Morse in these bands by Novices, Technicians or higher classes, there appears to be no need to prohibit such operation in the rules. The appropriate mechanism is the band plan.

- The A1A-only VHF bands:

  50.0-50.1 MHz (Regions 2 and 3 only)
  144.0-144.1 MHz

The A1A-only nature of the above bands does not hold in that beacons can operate FSK in these portions:

  50.06-50.08 MHz
  144.05-144.06 MHz

Again, there has been no history of inappropriate use of FSK Morse in the 50.0-50.1 and 144.0-144.1 MHz bands, thus no compelling need to prohibit it by federal regulation.

Accordingly, there does not appear to be a need for a separate designator for FSK Morse in that it should be permissible in the RTTY subbands. It should suffice to have a statement in Part 97 to the effect that for transmission of international Morse code frequency shifting of a carrier or subcarrier may be used wherever "RTTY" is permitted.

4. Telegraphy vs Telephony

These terms have little use in distinguishing the two basic emission groups of interest to radio amateurs because facsimile is a form of telegraphy as defined by the ITU Radio Regulations, given earlier in this paper, but operates in the phone bands.

5. RTTY and Data

The CCIR and Part 80 of the Commission's rules use the term "narrowband direct-printing (NB-DP)" for what is known as "radioteletype (RTTY)" by radio amateurs. The abbreviation "RTTY" is sufficiently descriptive, is familiar to amateurs, and is appropriate for use in Part 97 of the Commission's rules.

Although RTTY and packet radio are permitted in the same amateur frequency subbands, it is desirable to maintain a distinction between them because of their different attributes. The ITU emission designators distinguish between the two modes, in the third symbol -- type of information to be transmitted, by assigning the symbol B to "telegraphy -- for automatic reception" (i.e., NB-DP) and the symbol D to "data transmission, telemetry, telecommand" (which fits packet radio). Although "telemetry" and "telecommand operation" appear only in Subpart H (Amateur-Satellite Service) of Part 97, they are also permitted in the amateur service (but not called that) under section 97.69:

> ...an amateur radio communication may include digital codes which represent alpha-numeric characters, analogue measurements or other information. These digital codes may be used for such communications as (but not limited to) radio teleprinter, voice, fac-simile, television, communications to control amateur stations, models and other objects...

"Measurements," above, clearly indicates telemetry, while "control amateur stations, models and other objects" describes telecommand. Analysis indicates that the terminology in Part 97 of the Commission's is at variance with the definitions in the ITU Radio Regulations, which are:

> Telemetry: The use of telecommunication for automatically indicating or recording measurements at a distance from the measuring instrument.
>
> Space Telemetry: The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft.
>
> Telecommand: The use of telecommunication for the transmission of signals to indicate, modify or terminate functions of equipment at a distance.
>
> Space Telecommand: The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on an associated space

object, including the space station.

This problem could be solved by using the terms "telemetry" and "telecommand" in the amateur service rules and "space telemetry" and "space telecommand" in the amateur-satellite rules.

Accordingly, it would be appropriate to use the word "data" as a short form of "data, telemetry, telecommand," to include packet radio, remote measurements and remote control of objects.

6. Phone vs Voice vs Speech

There does not appear to be much distinction between the terms "phone," "voice" and "speech" in describing radiotelephony. However, the term "phone" is most familiar to radio amateurs and would be appropriate for Part 97.

Wherever "phone" is permitted, acceptable types of modulation should include MCW for the purpuse of providing Morse code practice interspersed with speech and incidental tones for such purposes as selective calling, alerting and controlling the level of the demodulated signal (e.g., compandoring).

A special descriptor may be needed for single-sideband phone operation in that there are two instances where double-sideband phone is not permitted. They are:

- o Alaska emergency frequency 5167.5 kHz, and
- o Novice and Technician phone operation on 28,300 to 28,500 kHz.

The descriptor "SSB" appears to be suitable as it is familiar to radio amateurs.

7. Facsimile and Slow-Scan Television

Although FAX and SSTV are permitted wherever "phone" operation is, neither the term "phone" or any other term seems to intuitively imply phone, FAX and SSTV. For example: They are all "voice-frequency" modes, but that term does not clearly indicate FAX and SSTV. Also, RTTY and data use voice-frequency modems. "Wideband" or "analog" do not fit, as detailed earlier. Thus, there is need to indicate in the rules where FAX and SSTV are permitted, either by using those two abbreviations or combining FAX, SSTV and fast-scan television under "image" communications.

D. Special Categories

The above descriptors (CW, MCW, RTTY, data, phone, SSB, and image) do not cover several special cases, which follow:

1. Spread Spectrum

The abbreviation "SS" appears to be suitable where spread-spectrum operation is permitted.

2. Pulse

The word "pulse" should be adequate to indicate the frequency bands where pulse type emissions are permitted.

3. Unmodulated/No Information

Present Part 97 rules specify NØN, which does not cover some variations such as amplitude, angle or pulse modulation of the main carrier but no information transmitted. There are legitimate uses of this type of transmission in the amateur service such as for transmitter adjustment, two-tone tests for linearity, antenna measurements, direction finding, ranging, telecommand and telemetry.

There does not appear to be a single English word or an ITU emission designator that encompasses the possible variations of no modulation or no information, except for XXN which would leave open the possibility of pulse modulation in bands where pulse should not be used. It seems practical to use XXN with a statement that pulse modulation may not be used except in those bands where pulse is specifically authorized.

VIII. Action Recommended

The following emission descriptors are appropriate for the amateur service and are recommended for use in Part 97 of the Commission's rules: (ITU emission designator combinations encompassed by these descriptors are shown parenthetically.)

CW — Single-channel amplitude-shift-keyed international Morse code emissions for aural or automatic reception. Typically, a beat-frequency oscillator (BFO) is required for aural reception. (ACHJR-1-AB, J2AB)

MCW — Single-channel International Morse code emissions with the use of a modulating tone for aural or automatic reception and not requiring the use of a beat-frequency oscillator at the receiver. (ACDFGHR-2-AB)

Phone — Telephony (transmission of speech and other sounds). Subcarrier tones incidental to the operation of a telephony channel should be permitted wherever phone emission is authorized. This includes signaling (alerting and selective calling) and having a separate subcarrier to control the level of demodulated signal (e.g., compandoring). (ACDFGHJR-123-E, B-789-E)

MCW for the purpose of station identification, and MCW for the purpose of providing international Morse code practice interspersed with speech should be permitted wherever phone emission is authorized.

Image — Single-channel facsimile and television emissions. (ACDFGHJR-123-CF)

Wherever image and phone emissions are permitted, independent-sideband emission of image and phone should be allowed within bandwidth limitations. (B-789-W)

RTTY — Single-channel narrowband direct-printing emissions using ITA2, ASCII (IA5) or AMTOR (conforming to the code, transmission rate and emission timing of CCIR Recs. 476-2 [1978], 476-3 [1978], 476-4 [1986], or 625 [1986], as appropriate). (ACDFGHJR-1-B, J2B) (Above 50.1 MHz: ABCDFGHJR-1279-BW should be permitted within bandwidth limitations.)

Angle-modulated single-channel international Morse code emissions should also be allowed wherever RTTY emission is permitted. (DFG-1-AB), (Above 50.1 MHz: 279 as a second symbol should also be permitted within bandwidth limitations.)

Data — Data transmissions (including packet radio), telemetry and telecommand. (ACDFGHJR-1-D, J2D) (Above 50.1 MHz: ABCDFGHJR-1279-DW should be permitted within bandwidth limitations.)

Pulse	Pulse transmissions. (KLMPQVW-X-X)
SS	Spread-spectrum tranmissions using bandwidth-expansion techniques. (ACDFGHJR-X-X) (Where pulse is permitted, also KLMPQVW-X-X)
XXN	Transmissions with no information. (XXN) (XXN should be permitted on any frequency below 50 MHz for brief periods for experimental purposes. Above 50 MHz, XXN should be permitted without the brevity restriction. XXN should not be taken to permit pulse operation except where pulse emission is authorized.)

July 2, 1987

To: All Digital Committee Members

RE: Digital Committee Meeting

The Digital Committee Meeting will be held on Sunday, August 30, 1987 at the Torrance Marriott.

The Torrance Marriott does not offer shuttle service to or from the airport (LAX). They suggest "Super Shuttle" service. The cost is $9.00 each direction. Obtain a receipt and the Leaque will reimburse the cost.

We would like to know, by July 17, 1987, whether or not you will be attending this year's Computer Networking Conference and the Digital Committee meeting. Please complete the form below and return in the franked envelope by July 17, 1987. This will insure proper accomodations well in advance of the conference. Thank you for your cooperation.

_____

Name _____

Address _____

_____

[] I will not be able to attend

[] I will be attending:

I'll need a room for [] July 28 [] July 29 [] both nights

I wish [] single [] double accomodations

[] I will be bringing a guest -- Name_____

PR#6/DIG.COMM/MATY

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AMERICAN RADIO RELAY LEAGUE
VHF/UHF Advisory Committee

NO.: 57-87
COPIES SENT TO ALL
VUAC MEMBERS.
DATE: 9-9-87

MEMO

TO: VUAC Distribution
FROM: H. Paul Shuch, N6TX, Chairman
COPY: VRAC, Digital Ad Hoc Comm., Membership Svcs. Comm.
DATE: 2 Sep 87
SUBJ: Swan Song

My final duty as VUAC Chairman was to participate, along with representatives of the VRAC and MSC, in a meeting of the ARRL Ad Hoc Committee on Amateur Radio Digital Communications, last week in Torrance CA. I am pleased to report that one outcome of that meeting was the development of a VHF/UHF Packet Frequency Plan with which all participants seemed satisfied. It is my understanding that the MSC will recommend this plan to the ARRL Board for adoption at its First 1988 Meeting.

Key elements of the Ad Hoc Committee recommendations are as follows:

1) 100 kHz wide packet channels at 430.05, .15, .25, .35, .45, .55, .65, .85, and .95 MHz (9 channels total). 430.75 is skipped to minimize interference to and from an ATV audio carrier there.

2) 25 kHz wide packet channels at 440.975, 441.000, .025, .050, and .075 MHz, plus an additional narrow-band channel at 431.025 MHz as a buffer for the wideband packet channels listed above.

3) VUAC is requested to revisit the interim 33 cm bandplan. In the interim, 3 MHz wide allocations (able to accommodate two 1.5 MBaud channels each) are recommended at 903 - 906 and 914 - 917 MHz.

4) 2 MHz wide channels at 1249.0, 1251.0, and 1298.0 MHz.

5) 100 kHz wide channels at 1299.05, .15, .25, .35, .45, .55, .65, .75, .85, and .95 MHz. It is expected that the lower of these frequencies will crossband duplex with the channels at 430.55 thru .95.

6) 100 kHz wide channels at 220.55, .65, .75, .85, and .95 MHz. It is expected that these will crossband duplex with the channels at 430.05 thru .45 MHz.

7) 25 kHz wide channels at 1294.025, .050, .075, .100, .125, .150, and .175 MHz, with Novice operation in mind.

8) 20 kHz wide channels at 223.40, .42, .44, .46, and .48 MHz, again with Novice enhancement in mind.

9) 20 kHz wide channels at 221.01, .03, .05, .07, and .09 MHz, to encourage occupancy of threatened spectrum.

I wish to express my personal appreciation to First Vice President Holladay for the professional way he pulled together inputs from diverse interest groups, to come up with a plan acceptable to all. My thanks also to those of you on the VUAC who invested so much time and effort in gathering input from your constituents and forwarding your recommendations in a timely manner. You will recognize in the Ad Hoc Committee recommendations quite a few frequencies which came directly from our Committee's study.

Finally, I want to tell you all that it is with mixed feelings that I relinquish the VUAC chair at this time. There's much work still to be done, which will require an active and aggressive Chairman, and I regret that my schedule precludes my filling that role. As much as I hate to leave strings untied, I feel it's better to bow out now, knowing I'm unable to continue devoting the time to this job which it really requires, than to hang on by my fingernails and have things fall thru the cracks. I'm confident that if you give our next Chairman (whoever that may be) the same kind of support, encouragement and assistance you gave me, the VUAC will continue to shine, and our efforts will benefit all of amateur radio.

Thanks again for being a super Committee. I'm proud to have served as your Chairman.

Vy 73,

Paul